DOCUMENT RESUME

ED 206 458 SE 035 486

AUTHOR Burnett, Jocelyn; And Others
TITLE A Product Of Our Times: Mathematics Resource Book K-8.
INSTITUTION Oklahoma State Dept. of Education, Oklahoma City.
PUB DATE 81
NOTE 134p.

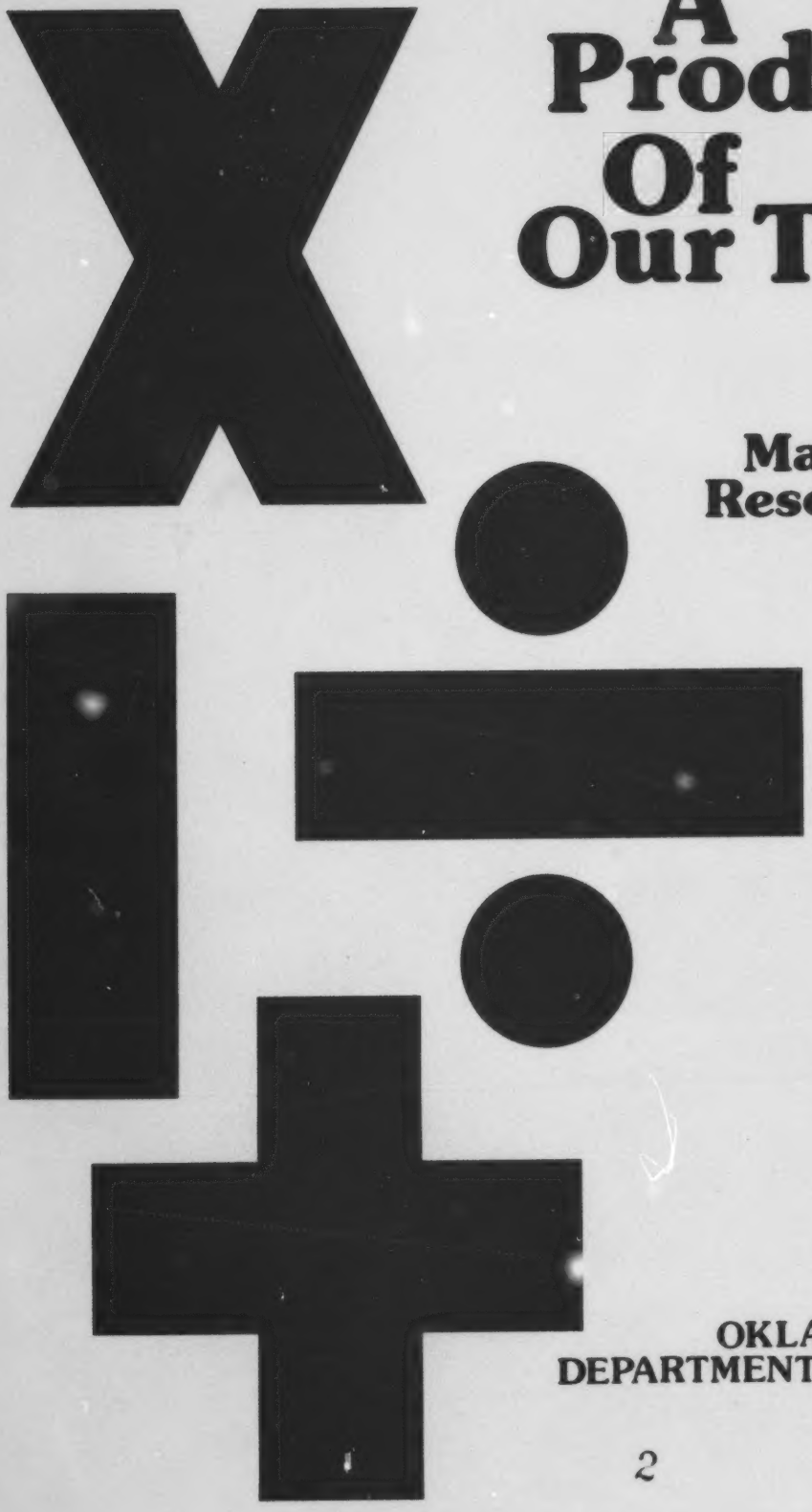
EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS Basic Skills; Behavioral Objectives; Cognitive Objectives; Educational Objectives; Elementary Secondary Education; *Instructional Materials; Junior High Schools; *Learning Activities; *Mathematics Curriculum; *Mathematics Education; *Mathematics Instruction; Middle Schools; *Resource Materials; Teaching Methods

ABSTRACT

This resource publication is primarily intended to aid elementary teachers in bringing each of their students to a higher level of mathematical competency. While the material has been designed for use in grades K-8, parts are considered appropriate for basic skills reinforcement at the secondary level. The document opens with a review of current developments and possible directions in mathematics education, and incorporates lengthy abstracts from the National Council of Supervisors of Mathematics (NCSM) "Position Paper on Basic Mathematical Skills." The bulk of this work consists of: (1) individual chapters devoted to appropriate teaching activities for grades K-3; (2) combined chapters for grades 4-6 and for grades 7-8; (3) a listing of resources that includes books arranged alphabetically by author, a list of publishers, and directories of periodicals and special resources; and (4) a reader evaluation form for the document. Each chapter on activities opens with an index list of behavioral objectives, and the content pairs each stated objective with detailed information on how to conduct a corresponding class activity. (MP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED206458



A Product Of Our Times

Mathematics Resource Book K-8

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

J. Craddock

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

OKLAHOMA STATE DEPARTMENT OF EDUCATION

SE 035 486

This publication, printed by Bond Printing, Oklahoma City, Oklahoma, is issued by the Oklahoma State Department of Education as authorized by Leslie Fisher, State Superintendent of Public Instruction. 14,000 copies have been prepared and distributed at a cost of $17,360.00

Copyrighted by the Oklahoma State Department of Education, 1981. The contents of this publication cannot be reproduced in part or whole and sold.

A Product Of Our Times

Mathematics Resource Book K-8

Oklahoma State Department of Education

DR. LESLIE FISHER, State Superintendent
LLOYD GRAHAM, Deputy Superintendent
TOM CAMPBELL, Associate Deputy Superintendent

J.D. Giddens	Jack Strahorn	S.H. McDonald
Assistant Superintendent	*Assistant Superintendent*	*Assistant Superintendent*
INSTRUCTION	STATE-FEDERAL	FINANCE

1981

OKLAHOMA STATE BOARD OF EDUCATION

Dr. Leslie Fisher	President	R.E. Carlton	Member
Winona Wettengel	Executive Secretary	R.L. Collins	Member
Dr. C.B. Wright	Member	Harry Shackelford	Member
Seay Sanders	Member	Jack Mace	Member

Foreword

The technological explosion currently underway in the world is affecting our lives in many ways. The accompanying increase in demand for technical skills has significance for curriculum in general and mathematics in particular. The need for citizens prepared with technological knowledge is certainly a Product of our Times.

An understanding of mathematical concepts, a grasp of analytical logic, an accuracy in computational skills and the ability to apply these skills to a wide variety of situations are essential to the education of each and every child. These competencies in mathematics are processes which begin in the early years.

For this reason, it is imperative that we as educators provide a sound and firm mathematical foundation in the elementary grades which can be built upon by our young people throughout their lives. Therefore, elementary teachers must strive to enable their students to gain in mathematical competency according to their respective capabilities.

We at the Oklahoma State Department of Education hope that this mathematics curriculum resource publication will prove valuable to elementary educators as they pursue this goal.

Leslie Fisher
State Superintendent of
Public Instruction

Preface

This resource material has been developed to acquaint Oklahoma educators with current developments and directions in the field of mathematics education. It has been designed for grades K-8, but parts of it would be appropriate for basic skills reinforcement at the secondary level.

The committee has developed teaching/learning activities to supplement the adopted textbooks. The additional resources listed have been found to be helpful in mathematics classrooms across the state. They are only suggested materials and certainly not all-inclusive. Teachers will want to utilize their schools' own supplemental materials as well.

We believe Oklahoma teachers will find the ideas presented in this publication useful as they work to facilitate the learning of mathematics in their classrooms.

Acknowledgments

PLANNERS AND PREPARERS

Ms. Jocelyn Burnett
Midwest City-Del City Schools

Mr. Tom Christman
Midwest City-Del City Schools

Ms. Lynday Lizar
Tuttle Schools

Ms. Jean Reherman
Oklahoma City Schools

Ms. Jennifer Southerland
Guthrie Schools

Ms. Grace Thompson
Edmond Schools

Ms. Judy Wilburn
Harrah

Ms. Yvonne Wood
Tuttle Schools

Ken Lease, Chairman
State Department of Education

OTHER CONTRIBUTORS

Students of "Methods and Materials of Mathematics for Elementary Teachers" (taught by Ms. Judy Wilburn, Central State University, Summer, 1980)

Students of "Elementary School Mathematics" (taught by Dr. Judy Ford, University of Oklahoma, Fall, 1980)

Teachers of Midwest City-Del City Schools

Ms. Sandra Boules, Artist
Ms. Nita West, Cover Artist
Mr. Allan Boules, Editor
Ms. Vicki Dean, Typist

COOPERATING SCHOOL SYSTEMS

Edmond Public Schools
Guthrie Public Schools
Midwest City-Del City Public Schools
Norman Public Schools
Oklahoma City Public Schools
Tulsa Public Schools
Tuttle Public Schools

STAFF OF CURRICULUM SECTION

Kay York, Administrator of Curriculum

Leonard Bates, Deputy Director of Curriculum Services

John Folks, Executive Director of Instructions

Table of Contents

	Page
Foreword	3
Preface	5
Acknowledgements	7
Table of Contents	9
Current Developments and Possible Directions	11
Kindergarten	17
Grade One	31
Grade Two	49
Grade Three	63
Grades 4-6	83
Grades 7-8	111
Resources	135
Evaluation	147

Current Developments and Possible Directions

There are indications that the 1980's may be a time of renewed public interest in mathematics education. Certainly the "Back-to-Basics" proponents have leveled some of their criticisms at supposed inadequacies in the teaching and learning of mathematics. The mass media recently have run articles contrasting mathematics achievement of American students with those of other technologically advanced societies. Concern for the gifted and talented has sparked discussion and action on providing a sufficiently challenging mathematics curriculum for all students. The increased availability of more sophisticated calculators at reasonable costs and the ever-expanding use of micro-computers naturally raise issues about mathematics education.

Educators concerned with the teaching and learning of mathematics have been responding actively to this renewed public interest. They also have been attempting to inform their colleagues and the general public of other concerns about the teaching and the learning of mathematics.

First, in 1977 the National Council of Supervisors of Mathematics published a Position Paper on Basic Mathematical Skills. This paper listed the following as the ten basic skills all students should be developing in the study of mathematics.

1. Problem Solving

   Learning to solve problems is the principal reason for studying mathematics. Problem solving is the process of applying previously acquired knowledge to new and unfamiliar situations. Solving word problems in texts is one form of problem solving, but students also should be faced with nontextbook problems. Problem-solving strategies involve posing questions, analyzing situations, translating results, illustrating results, drawing diagrams, and using trial and error. In solving problems, students need to be able to apply the rules of logic necessary to arrive at valid conclusions. They must be able to determine which facts are relevant. They should be unfearful of arriving at tentative conclusions, and they must be willing to subject these conclusions to scrutiny.

2. Applying Mathematics to Everyday Situations

   The use of mathematics is interrelated with all computation activities. Students should be encouraged to take everyday situations, translate them into mathematical expressions, solve the mathematics, and interpret the results in light of the initial situation.

3. Alertness to the Reasonableness of Results

Due to arithmetic errors or other mistakes, results of mathematical work are sometimes wrong. Students should learn to inspect all results and to check for reasonableness in terms of the original problem. With the increase in the use of calculating devices in society, this skill is essential.

4. Estimation and Approximation

Students should be able to carry out rapid approximate calculations by first rounding off numbers. They should acquire some simple techniques for estimating quantity, length, distance, weight, etc. It is also necessary to decide when a particular result is precise enough for the purpose at hand.

5. Appropriate Computational Skills

Students should gain facility with addition, subtraction, multiplication, and division with whole numbers and decimals. Today it must be recognized that long, complicated computations will usually be done with a calculator. Knowledge of single-digit number facts is essential and mental arithmetic is a valuable skill. Moreover, there are everyday situations which demand recognition of, and simple computation with, common fractions.

Because consumers continually deal with many situations that involve percentage, the ability to recognize and use percents should be developed and maintained.

6. Geometry

Students should learn the geometric concepts they will need to function effectively in the three-dimensional world. They should have knowledge of concepts such as point, line, plane, parallel, and perpendicular. They should know basic properties of simple geometric figures, particularly those properties that relate to measurement and problem-solving skills. They also must be able to recognize similarities and differences among objects.

7. Measurement

As a minimum skill, students should be able to measure distance, weight, time, capacity, and temperature. Measurement of angles and calculations of simple areas and volumes are also essential.

Students should be able to perform measurement in both metric and customary systems using the appropriate tools.

8. Reading, Interpreting, and Constructing Tables, Charts, and Graphs

   Students should know how to read and draw conclusions from simple tables, maps, charts, and graphs. They should be able to condense numerical information into more manageable or meaningful terms by setting up simple tables, charts, and graphs.

9. Using Mathematics to Predict

   Students should learn how elementary notions of probability are used to determine the likelihood of future events. They should learn to identify situations where immediate past experience does not affect the likelihood of future events. They should become familiar with how mathematics is used to help make predictions such as election forecasts.

10. Computer Literacy

    It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society, such as their use in teaching/learning, financial transactions, and information storage and retrieval. The "mystique" surrounding computers is disturbing and can put persons with no understanding of computers at a disadvantage. The increasing use of computers by government, industry, and business demands an awareness of computer uses and limitations.

(Extracted from the Position Paper on Basic Mathematical Skills, published in 1977 by the National Council of Supervisors of Mathematics. Used by permission.)

Second, in 1980 the National Council of Teachers of Mathematics published a thirty-page booklet entitled An Agenda for Action: Recommendations for School Mathematics of the 1980's. This booklet may become the standard against which school mathematics programs are compared in this decade. In the booklet the eight recommendations listed below are presented, together with brief explanations and suggested steps for achieving them. The recommendations are:

1. problem solving be the focus of school mathematics in the 1980's;

2. basic skills in mathematics be defined to encompass more than computational facility;

3. mathematics programs take full advantage of the power of calculators and computers at all grade levels;

4. stringent standards of both effectiveness and efficiency be applied to the teaching of mathematics;

5. the success of mathematics programs and student learning be evaluated by a wider range of measures than conventional testing;

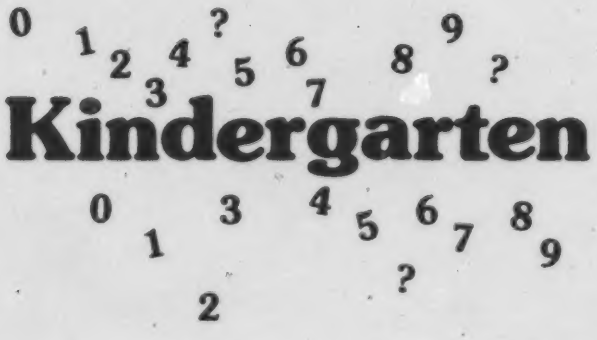
6. more mathematics study be required for all students and a flexible curriculum with a greater range of options be designed to accommodate the diverse needs of the student population;

7. mathematics teachers demand of themselves and their colleagues a high level of professionalism;

8. public support for mathematics instruction be raised to a level commensurate with the importance of mathematical understanding to individuals and society.

(From An Agenda for Action, page 1. Used by permission of NCTM)

Oklahomans concerned with the teaching and learning of mathematics should obtain a copy of this booklet and study it carefully.


0 1 2 3 4 ? 5 6 7 8 9 ?
Kindergarten
0 1 2 3 4 5 6 7 8 9 ?

Kindergarten

Objectives

		Page
K-1	Recognize a group of objects as a set	18
K-2	Compare sets by size, shape and color	18
K-3	Compare sets involving the concepts of more, less and equal	18
K-4	Recognize numerals and show relationship between number of objects and the numerals 0-10	19
K-5	Order numbers 0-10	20
K-6	Count by ones to twenty	20
K-7	Join two sets of concrete objects (each with 0-5 members)	20
K-8	Separate concrete objects from a set with five members or less	21
K-9	Use comparative terms such as tall-short, long-short, large-small, heavy-light, etc	22
K-10	Recognize and utilize instruments of measure such as clock, cup, pint, quart, liter, ruler, thermometer, yardstick and meter stick	22
K-11	Recognize and interpret information from a picture and bar graph	23
K-12	Identify "one-half" and "one whole"	24
K-13	Recognize square, circle, triangle, rectangle (perhaps even pentagon and hexagon)	25
K-14	Identify spatial relationship of objects, e.g. top, bottom, behind, between, next, far, near, below, above, etc	25
K-15	Order objects or pictures of objects in sequences of time, size and/or quantity	26
K-16	Duplicate and extend patterns of objects or patterns of pictures of objects	27

★K-1 OBJECTIVE: Recognize a group of objects as a set.

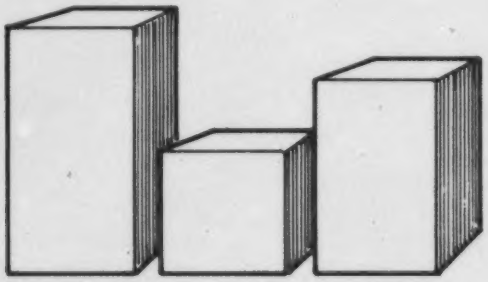
ACTIVITY: Children find sets of like objects within the room (such as chairs, tables, books, boxes, etc.).

★K-2 OBJECTIVE: Compare sets by size, shape and color

ACTIVITIES:

(a) As a warm-up, play "I spy colors". One student chooses a red object in the room and says, "I spy something red". Each attempt to guess what the object is. The student with the correct guess then becomes the spy.

(b) Side by side on a table place three blocks of the same base but obviously of different heights and color. Point out that one block is the tallest and one is the shortest. Have students identify these.



(from Developmental Mathematics, Tulsa Public Schools, 1979, page 17. Used by permission.)

★K-3 OBJECTIVE: Compare sets involving the concepts of more, less and equal

ACTIVITIES:

(a) Let the students act out addition of two sets. Call three girls to the front to act as a set of three. Call two boys to the front to act as a set of two. Ask questions of the class such as: "How many children do we have in this

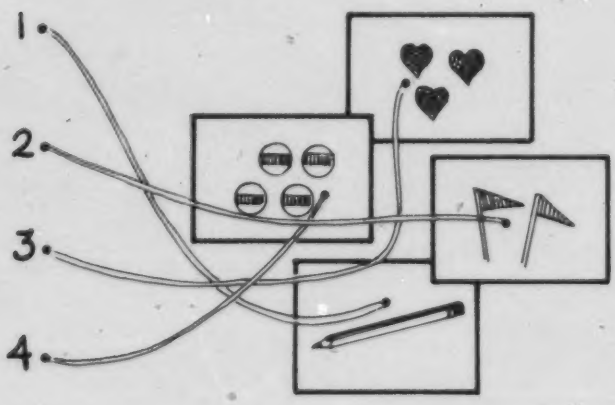
set?" (Point to the girls.) "How many children do we have in this set?" (Point to the boys.) "How many children do we have if we put the two sets together?" (Have a child count the two groups together.) Next, have the two sets join hands for boy-girl-boy-girl-girl arrangement. Then ask questions like: "Are the two sets the same size? Which set is bigger, boys or girls? How many boys would we need to have come up front to make the sets the same size?"

(b) Show the students a string of five blue beads and a string with eight red beads. Let someone unstring the beads to match up the beads blue to red. Ask questions about the string with the most beads. Repeat the activity with different colored beads and different amounts.

(from Developmental Mathematics, Tulsa Public Schools, 1979, page 20. Used by permission.)

★ K-4 OBJECTIVE: Recognize numerals and show relationship between number of objects and the numerals 0-10.

ACTIVITY: Prepare a bulletin board as illustrated below. Connect pieces of yarn with thumb tacks. On rest of the board place sets of real things glued to background sheets. Let a child name the numeral and then connect it with the correct set by winding yarn around tack in set.



★K-5 OBJECTIVE: Order numbers 0-10

ACTIVITY: Hang a clothesline across one end of the room. Use real or paper socks with numerals 0-10 on them. Provide clothespins and let the students order the numbers by hanging the socks.

(from Developmental Mathematics, Tulsa Public Schools, 1979, page 21. Used by permission.)

★K-6 OBJECTIVE: Count by ones to twenty.

ACTIVITY: Sing "One Little Indian", then make headbands and let the students act out the song.

★K-7 OBJECTIVE: Join two sets of concrete objects (each with 0-5 members).

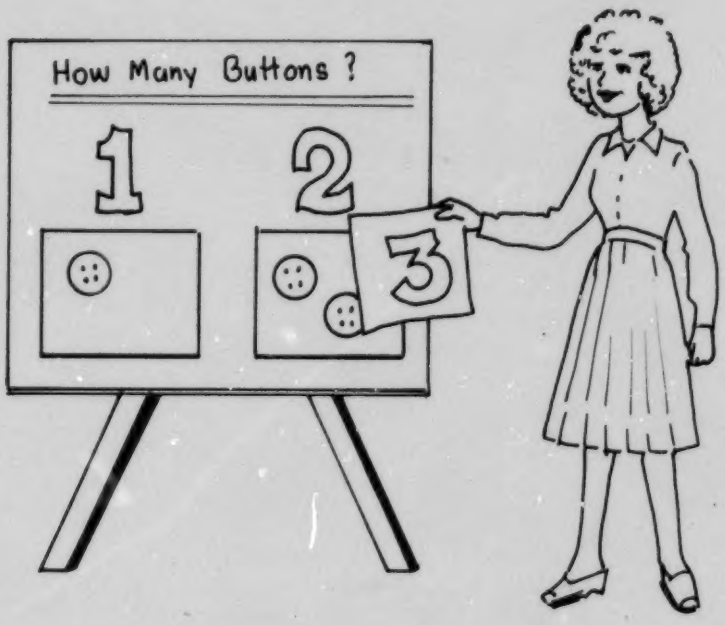
ACTIVITY: Use any common items like buttons, shoelaces, crayons, pens. Have enough of each item so children can work separately and follow along.

Place one button glued to some felt onto the flannel board. Ask "How many buttons are on this board?" Place the numeral "1" on the flannel board.

Ask, "How many buttons on this piece of bright cloth?" as you place another piece with two buttons glued on. Then

place numeral "2" on flannel board and ask "How many buttons in all?" After correct response place cloth with 3 buttons and the numeral "3" on flannel board.

Repeat this activity with many different items and larger numerals.



★ K-8 OBJECTIVE: Separate concrete objects from a set with five members or less. (readiness for subtraction)

ACTIVITY: Using a basket and five apples, have child count apples being placed in basket. Call another child up to take out so many apples and put them on table. Then count how many are left in basket (with basket tilted so all can check).

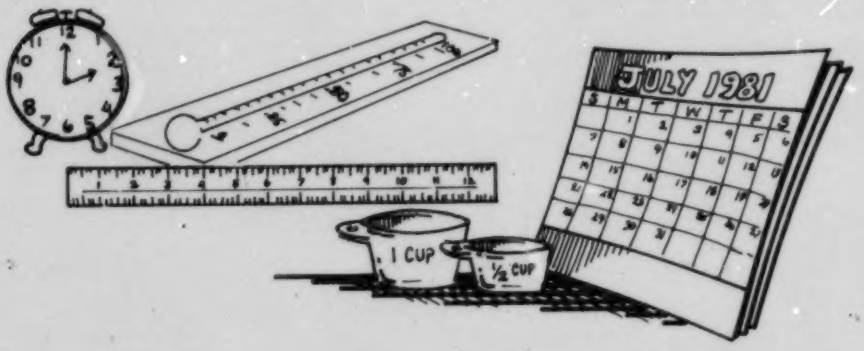
★K-9 OBJECTIVE: Use comparative terms such as tall-short, long-short, large-small, heavy-light, etc.

ACTIVITY: Utilize wide variety of materials in discussing comparison with children, e.g. yarn, ribbon, shoestrings, lollipops, nuts and bolts, shoes, coats, jars, boxes, cans, inflated ballons.

★K-10 OBJECTIVE: Recognize and utilize instruments of measure such as calendar, clock, cup, pint, quart, liter, ruler, thermometer, yardstick and meter stick.

ACTIVITIES:

(a) Display measurement instruments where children can handle them. Provide on-going experiences for children with these instruments by checking daily temperatures, having children weigh themselves, measure their height, etc.



Note:

i) This activity can lead naturally into some work on making charts and graphs.

ii) There is evidence that some children cannot deal effectively with standardized measurement until third grade. Therefore, it should be kept in mind that the measuring activities in the early primary years are designed to acquaint the children with the instruments and how these instruments are used. Competency in their use is not expected.

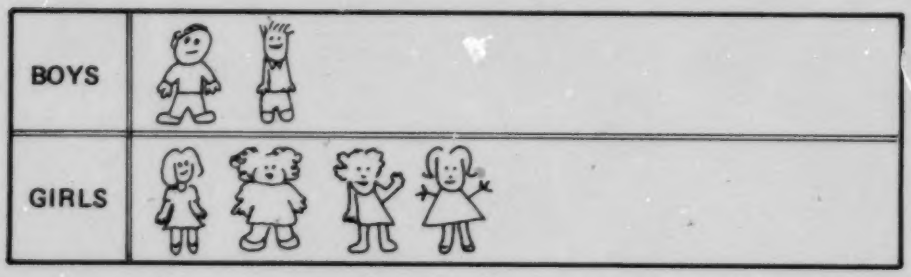
The teaching of measurement is covered in detail in Metric Measurement: A Handbook for Elementary Teachers And Administration. (Oklahoma State Department of Education, 1977)

(b) Use a teacher-made calendar with 1½" squares for the days and cut outs of clouds and suns. Each day a child places either a cloud or a sun on the calendar. As the week progresses discuss "How many cloudy days? How many sunny days? How many more sunny than cloudy days?" Of course, this can be continued for one or more months and the detail enlarged, e.g., dark clouds, partly cloudy, fog, etc.

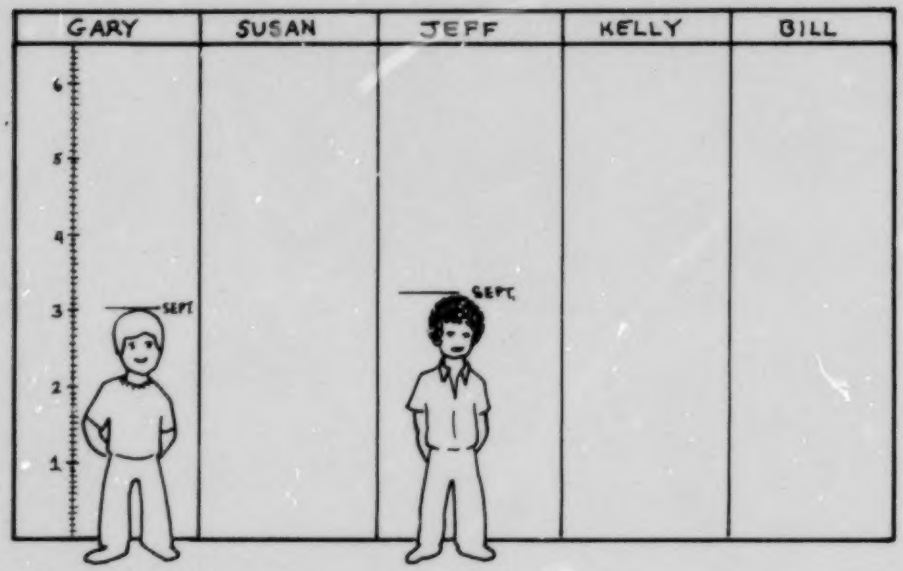
★ K-11 OBJECTIVE: Recognize and interpret information from a picture and bar graph.

ACTIVITIES:

(a) Prepare a picture graph of the number of boys and girls in the class for the bulletin board. Each child can draw a small image of self, cut out the image and paste it onto the large sheet. Lead discussions on "How many boy images on graph and how many boys in class?", etc.



(b) Use a large sheet of posterboard as a backdrop and measure the children's heights at several months (colorcoded). Then fill in the measuring line to make bar graphs. Discuss growth patterns and amounts.



★ K-12 OBJECTIVE: Identify "one-half" and "one whole".

ACTIVITY: Use apples, oranges, cups or jars filled with colored water, doughnuts, etc. to discuss whole units. Then cut or divide them into halves (by careful division one could also work on "thirds" with the children).

Commercial items like egg-shaped plastic containers or the permanent Easter eggs that separate into halves when opened can also be used.

★ K-13 OBJECTIVE: Recognize square, circle, triangle, rectangle (perhaps even pentagon and hexagon).

ACTIVITIES:

(a) Give the children containers with different shaped buttons and other objects and have them sort according to particular shapes being taught.

(b) Designate one station of the room as the "shape station". Help children gather, prepare, and display objects for each new shape being taught. Also, try contrasting some differences between two and three-dimensional objects (e.g. square vs cube).

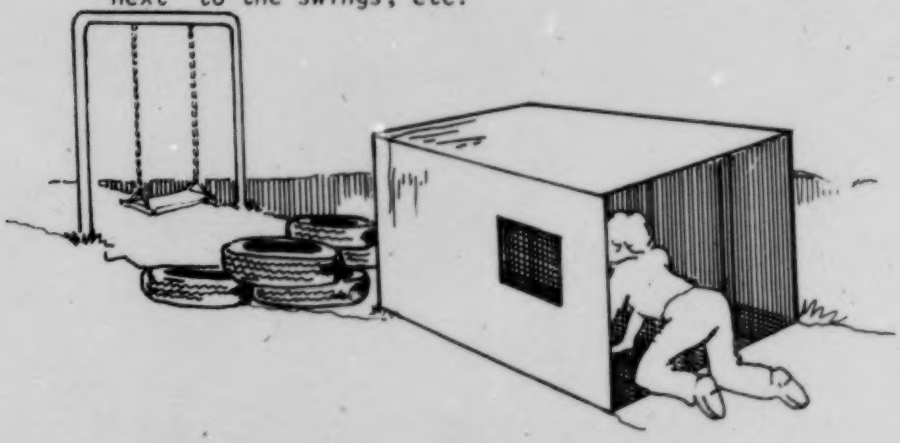
(c) Provide children with posterboard cutouts of various shapes. Allow them to use the various shapes to make designs after coloring each shape differently.

★ K-14 OBJECTIVE: Identify spatial relationship of objects, e.g. top, bottom, behind, between, next, far, near, below, above, etc.

ACTIVITIES:

(a) Walk "on", "beside", "in", etc. a large shape that has been drawn on the floor.

(b) Prepare an "obstacle course" for the children where they must crawl "through" a box, "over" the monkey bars, stand "next" to the swings, etc.



(c) Stand a child "in front of" a mirror and say "Put your hand on top of your head; put your left hand beside your right; put your finger on your nose", etc.

(d) Use a flannel board representation of some trees, squirrels and acorns and direct a student to, "Place one acorn between two squirrels. Put all acorns under the brown tree", etc.

Note: Some experts in mathematics contend that a well-developed sense of spatial relations is the key to comprehension of higher mathematics. So time spent on experiencing spatial relationships may prove very useful to young people.

★K-15 OBJECTIVE: Order objects or pictures of objects in sequences of time, size and/or quantity.

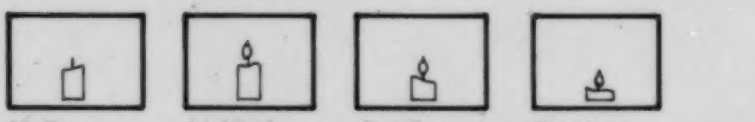
ACTIVITIES:

(a) Provide a group of blocks, pyramids, pieces of crayons, etc. and have children order them left to right and from smallest to largest.

(b) Provide groups of pencils or popsicle sticks tied in bundles of 1, 2, 3, 4, etc., and have children order them left to right (least to most).

(c) Let children act out short stories such as "Billy Goat Gruff" and be sure they cross the bridge in the right order.

(d) Use cards with pictures of a progression and have children hold one card each and line up in proper sequential order.

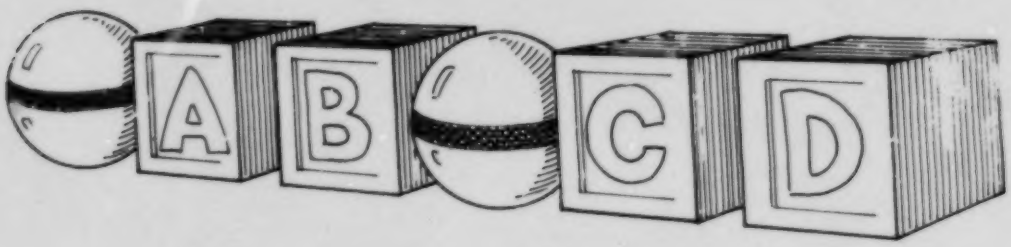


Unlit Candle | Lighted Candle | Smaller Candle | Candle Almost Burned Out

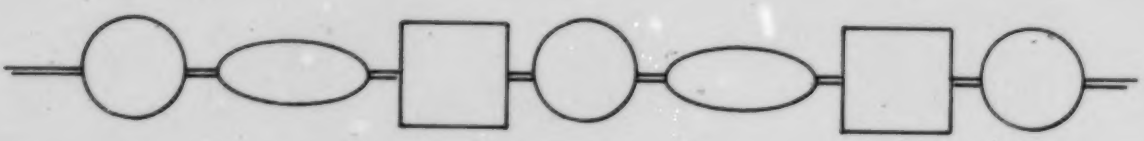
★K-16 OBJECTIVE: Duplicate and extend patterns of objects or patterns of pictures of objects.

ACTIVITIES:

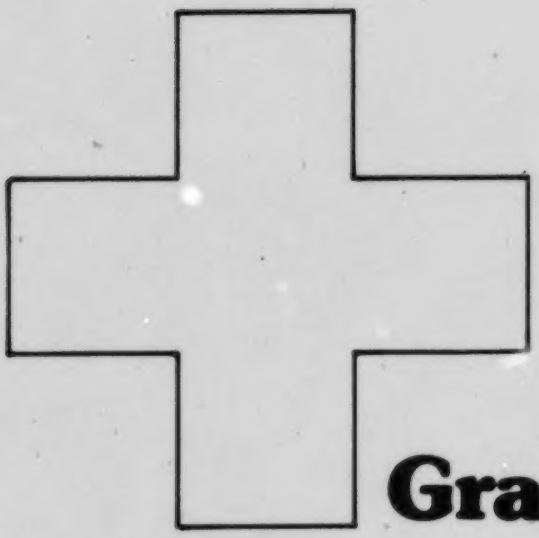
(a) Provide a patterned arrangement of objects, e.g., ball, block, etc., and allow child to duplicate, extend, and discuss the pattern with same items at his/her desk.



(b) Use a flannel board for displaying patterns of different flannel shapes. Children could string similarly shaped beads to duplicate and extend given pattern.



(c) Have the children make and talk about their own patterns.



Grade 1

Grade One

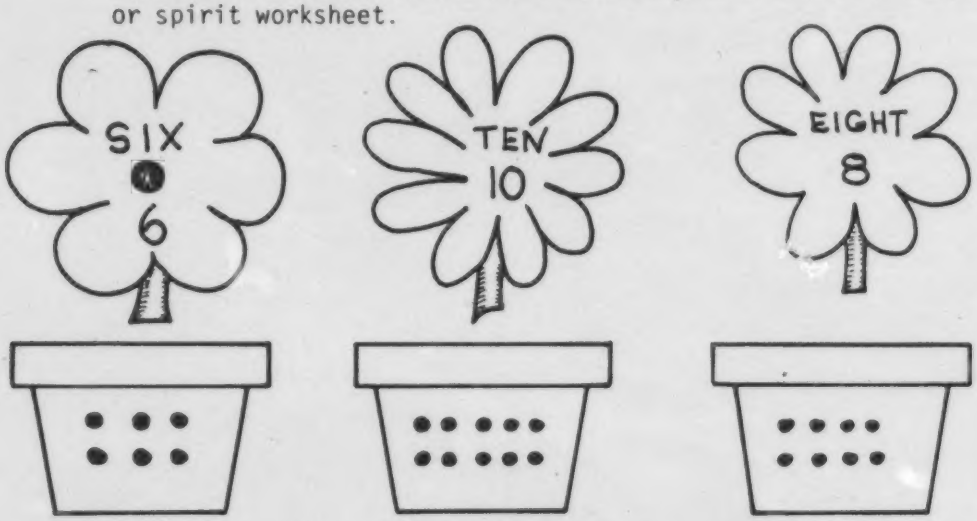
OBJECTIVES

		Page
1-1	Demonstrate the relationship between the number of objects and the numerals 1,2,3, . . ., 20.....	33
1-2	Count consecutively to 100.....	34
1-3	Read and write numerals 1-100.....	34
1-4	Identify how many ones make ten and practice place value skills.....	35
1-5	Identify " < " and " > ".....	35
1-6	Recognize the basic addition facts for any two numbers (0-10).....	36
1-7	Recognize the basic subtraction facts for 0's-10's.....	37
1-8	Interpret and write equations for real problems as well as picture problems with sums to twenty-four and corresponding differences.....	38
1-9	Measure with non-standard units.....	39
1-10	Read the time on a face clock at the hour or half-hour..	39
1-11	Utilize the calendar in identifying month, week, and day.....	40
1-12	Measure powders and liquids with cups, pints, quarts, gallons, litres.....	40
1-13	Practice measuring with rulers to nearest half inch and nearest centimeter.....	40
1-14	Recognize halves, thirds, and fourths and their symbols 1/2, 1/3, 1/4.....	41
1-15	Identify square, triangle, rectangle (and perhaps pentagon, hexagon, heptagon, octagon).....	41
1-16	Prepare, read, and interpret simple bar and line graphs.	42
1-17	Identify spatial relationships between objects.....	43
1-18	Introduce and practice addition and subtraction of two-digit numbers without regrouping.....	43
1-19	Order objects or pictures of objects in sequence of color, quantity, size, time, etc.....	46

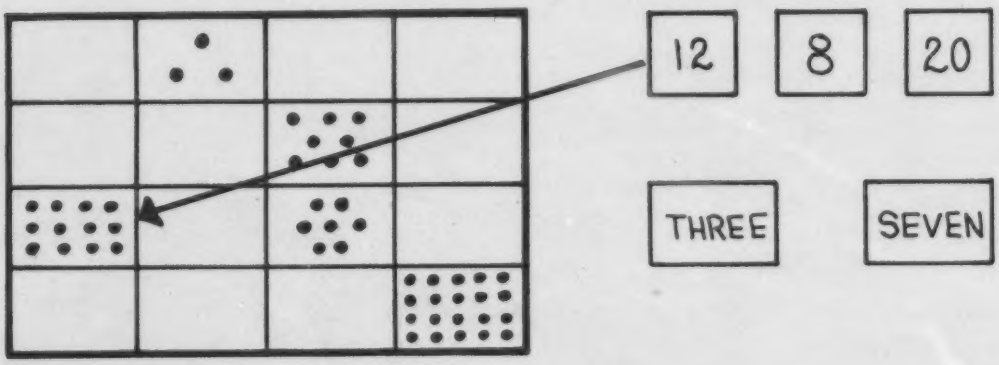
★1-1 OBJECTIVE: Demonstrate the relationship between the number of objects and the numerals 1,2,3, . . ., 20.

ACTIVITIES:

(a) Prepare "plant numbers" as illustrated below. Children can match flower with correct pot on bulletin board or spirit worksheet.



(b) Have children place the right numeral card on the proper square as shown.



★1-2 OBJECTIVE: Count consecutively to 100.

ACTIVITY: Provide a bowl containing 100 jellybeans or raisins. Child counts and removes each item.

Note: Use this activity to have child count by 2's, 3's, 5's, or 10's. In these situations, child removes two objects at one time or 3 objects at one time, etc. while saying "2", "4", "6", "8" . . . . .

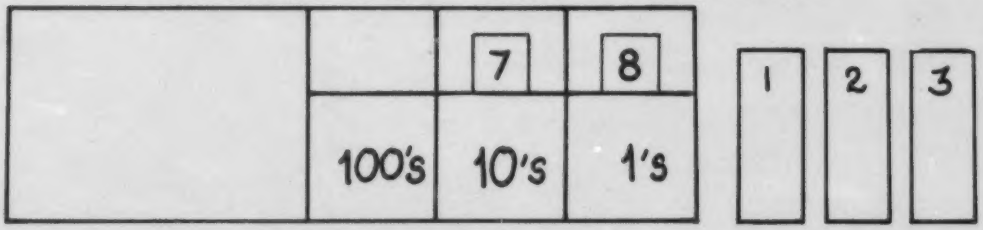
★1-3 OBJECTIVE: Read and write numerals 1-100.

ACTIVITIES:

(a) Use overhead transparency as illustrated. Have children read given numerals and tell the missing ones. Follow up with similar spirit duplicated worksheets.

50	51			54			57		
60		62			65				
	71	72				76			

(b) Prepare "pocket place value" charts from construction paper and count out 2 sets on ten strips as shown. Say a number from 0-99 and have child put correct strips in appropriate pockets. Also, have students read number correctly on occasions when strips already have been inserted.

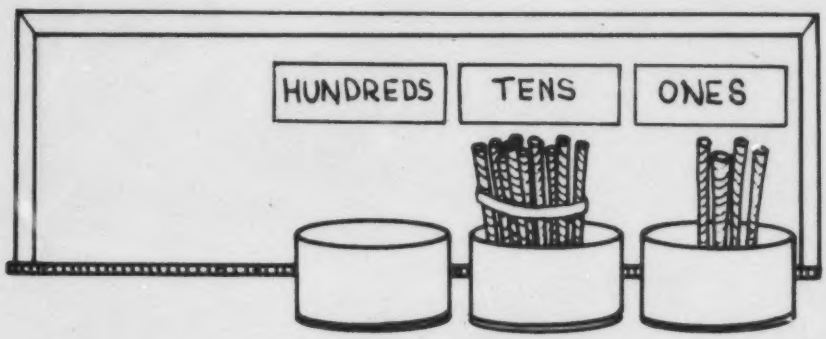


(from Developmental Mathematics, Tulsa Public Schools, 1979, page 37. Used by permission.)

29

★1-4 OBJECTIVE: Identify how many ones make ten and practice place value skills.

ACTIVITY: See illustration. Show a "tens and ones" chart on the blackboard above the cans. Put fourteen sticks or straws in the ones can, for example. Then have a child count out ten sticks and put a rubber band around them.



Ask: "How many bundles of ten sticks? Yes, there is one bundle to ten."

Then, have the child put the bundle of ten in the tens can.

Ask: "Are there enough sticks to make another bundle of ten sticks? No, there are not. So we only have one bundle of ten."

Write the numeral 1 in the "tens" place then ask: "How many sticks are left over? Yes, four remain." Write the numeral 4 in the ones' place.

Repeat this process with many two-digit numerals or, for variety, use bags of marbles or pieces of gum or pencils instead of sticks.

Remember, it is crucial that children develop a clear image of what place value means.

★1-5 OBJECTIVE: Identify " < " and " > ".

ACTIVITY: Use a cutout of a small alligator with mouth open wide. Explain that if the alligator could choose between two numbers he would eat the larger. Then have a child turn the

alligator so that the open jaws are towards the larger number.

NOTE: Alligator should be drawn on transparent material so it can be flipped on either side.

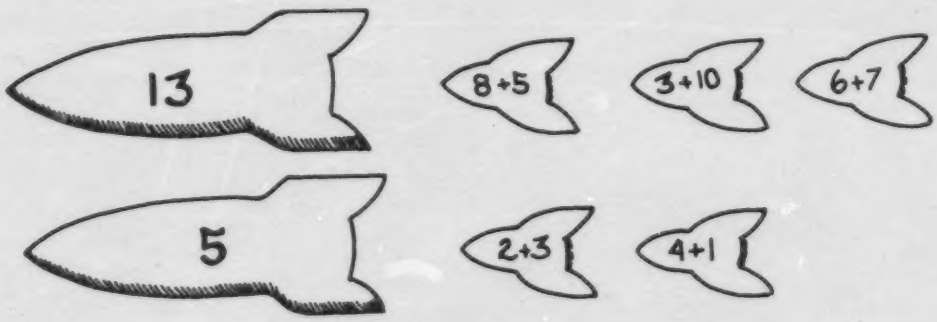
(from Developmental Mathematics, Tulsa Public Schools, 1979, page 38. Used by permission.)

★ 1-6 OBJECTIVE: Recognize the basic addition facts for any two numbers (0-10).

ACTIVITIES:

(a) Give students daily practice in combining real concrete objects, counting the results, then saying the appropriate formula such as, "5 apples + 3 apples = 8 apples". Remember, children need lots of practice with real objects (pencils, paper clips, pieces of fruit) before working with pictures of things.

(b) Make several large spaceships with cardinal numbers on them and "shuttle-crafts" with addition sums to go with each spaceship. Have children match shuttle-crafts to each spaceship.

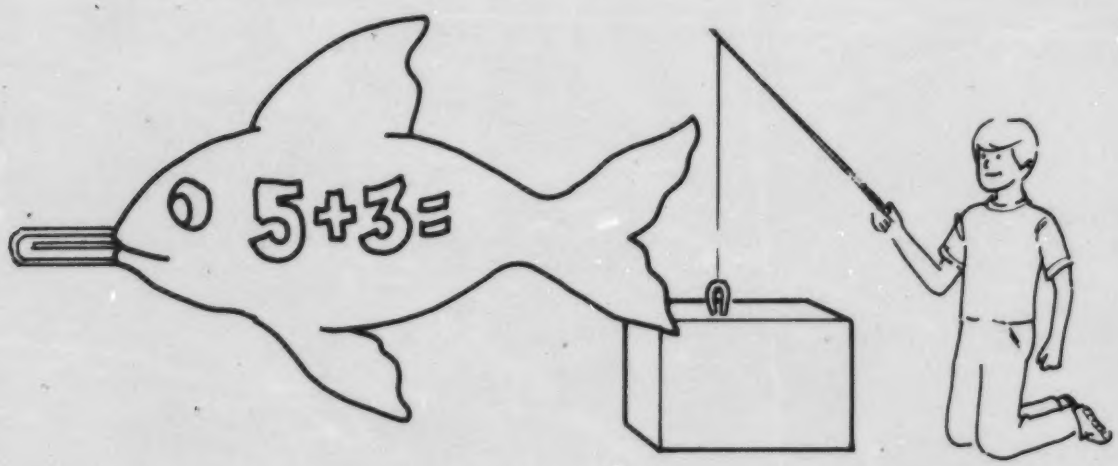


31

This activity can be varied by using large fish and baby fish, trains with boxcars, sailboats with flags, etc.

(c) Use a square box covered in light blue paper to look like a pond. Construct fish as shown below using paper clips and construction paper. Make fishing pole from an old stick, fixed string, and magnet. Have four children take turns fishing. If a child knows the answer before checking on the back small fin, child can keep fish. If child doesn't, the fish has to be put back.

Note: "Subtraction fish" can also be made. Laminating will help to extend the durability of the fish.



(activity (b) from Developmental Mathematics, Tulsa Public Schools, page 38. Used by permission.)

★ 1-7 OBJECTIVE: Recognize the basic subtraction facts for 0's - 10's.

ACTIVITIES:

(a) Use spinners and game boards. Each child spins twice, writes down each number, subtracts the difference and moves the marker appropriate jumps.

(b) Use flash cards and play "sly fox". Pick a child in each to be "sly fox". The student stands next to first child in row and both are shown a flash card subtraction problem.

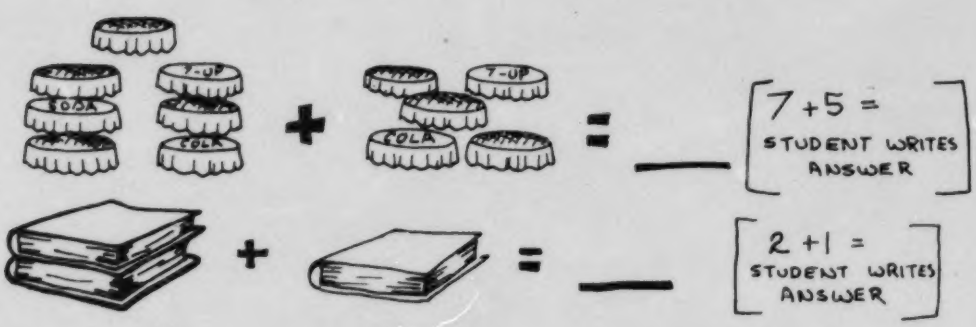
These two children try to beat each other saying or writing the difference. If "sly fox" is first, continue on to next child; if not, winner becomes "sly fox".

★ 1-8 OBJECTIVE: Interpret and write equations for real problems as well as picture problems with sums to twenty-four and corresponding differences.

ACTIVITIES:

(a) Prepare groups of things to be added (cups, bottle caps, books, small dolls) at different tables. Every child should stop at each table and perform the addition as directed. Provide each child with a worksheet on which a picture of each addition can be shown with space for the child to write the equation that goes with the drawing.

Note: Similar situations should be set up for subtraction.



(b) Make felt figures of dresses, cars, etc. and create flannel board addition or subtraction situations for which the child must write an equation . . . including answer.

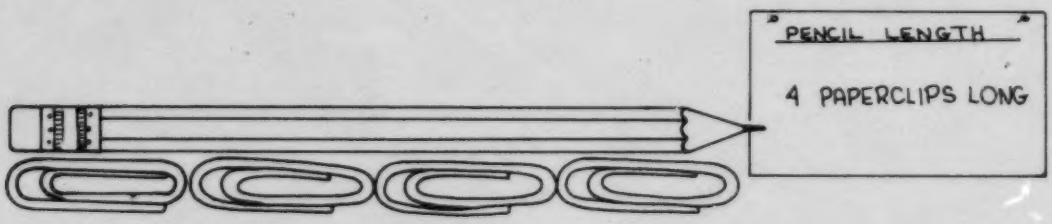
★1-9 OBJECTIVE: Measure with non-standard units.

ACTIVITIES:

(a) Choose some distances in the classroom to measure: lengths of windows, length of a row. Form small groups of students and have each group measure the distances with a shoe as a unit. Discuss the results, particularly why their measurements differ.

(b) Assign separate groups to measure objects, such as a work table, shelves, the teacher's desk with units like brand-new pencils, paperclips, strips of posterboard, straws, erasers. Discuss results.

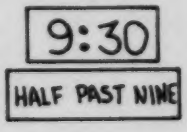
(c) Each child should measure the length of a few pencils using paperclips as a unit. Record the results on the board. Discuss the results giving particular attention to the value of all persons using the same unit of measure.



★1-10 OBJECTIVE: Read the time on a face clock at the hour or half-hour.

ACTIVITY: Write minute counters around outside of classroom wall clock and color code the minute hand to match. Use time cards to match the various half-hour intervals during the day. Cards show both "nine-thirty" and "half-past nine".

Similar practice clock faces can be constructed and laminated with moveable hands. Have children match correct hand position with appropriate time card.



★ 1-11 OBJECTIVE: Utilize the calendar in identifying month, week, and day.

ACTIVITY: Prepare a large block wall calendar for each month. The square for each day should be 3" x 3". On the last week of each month, make note with children of special day's on the coming month's calendar (holidays, student brithdays, school fairs, etc.). Then each day the calendar should be checked for these special days. The type of weather could also be noted (cool, cold, warm, hot, snowy, rainy, cloudy, partly cloudy, clear).

★ 1-12 OBJECTIVE: Measure powders and liquids with cups, pints, quarts, gallons, litres.

ACTIVITY: Set up centers with various containers (tin cans, sandwich bags, freezer containers, small boxes) of different materials (soap powder, sugar, and colored water) and standard measuring devices. Provide worksheets or have the students keep notebooks and specify which materials should be measured into a given container.

Variations on this activity should be done throughout the school year to reinforce familiarity with the various units. A scrapbook of photos of this activity will facilitate retention.

★ 1-13 OBJECTIVE: Practice measuring with rulers to nearest half inch and nearest centimeter.

ACTIVITIES:

(a) Have children measure various items in the classroom: length of books, length and width of desks, height of chairs, length of their pencils, etc. and record their measurements in notebooks or on worksheets.

(b) Make a measuring station. Display pictures of an umbrella, an ice cream bar, a centipede, some worms, etc. Make cards with the correct measure for each picture (actual

objects would be even better). Child should measure with a ruler and match correct card to show length.

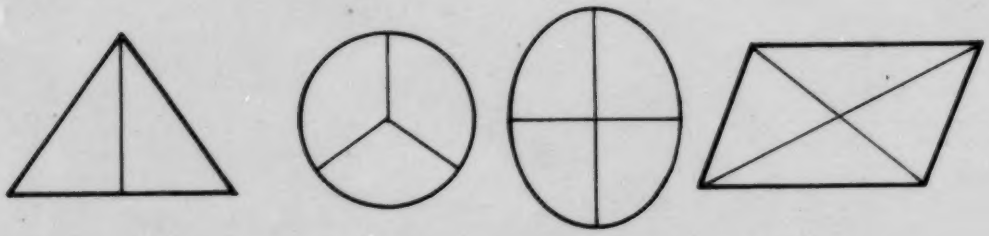
★ 1-14 OBJECTIVE: Recognize halves, thirds, and fourths, and their symbols: 1/2, 1/3, and 1/4.

ACTIVITIES:

(a) See Objective 1-18. Use same idea. Start by cutting actual objects like grapefruits, pears, bananas into 2, 3, or 4 equal parts. Follow this with chance for children to draw pictures of the experience. Discuss the process and conclude by having the children write the appropriate fractional form, 1/2, 1/3, 1/4, next to the drawing.

Note: It is also important for children to recognize that fractional forms do not represent unequal parts. So cut a few objects unequally and discuss this with the children.

(b) Out of posterboard, make laminated cutout puzzles for a wide variety of shapes. Discuss fractional parts.



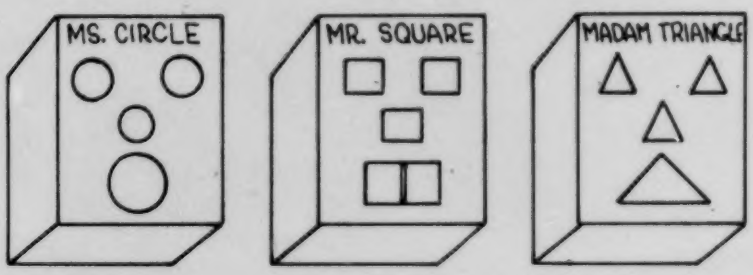
★ 1-15 OBJECTIVE: Identify square, triangle, rectangle (and perhaps, pentagon, hexagon, heptagon, octagon).

ACTIVITIES:

(a) Place 5" shapes on floor inside large circle. Have children hop into circle, choose a shape, and name it. If

correct, child may keep shape and participate again. If incorrect, child must leave shape on floor and must wait until next turn.

(b) Cover four shoe boxes with different colored paper. Cut out eyes, nose and large mouth as shown below. Cut out a quantity of different size circles, squares, triangles and rectangles from construction paper. Students place construction paper shapes in correct mouth.

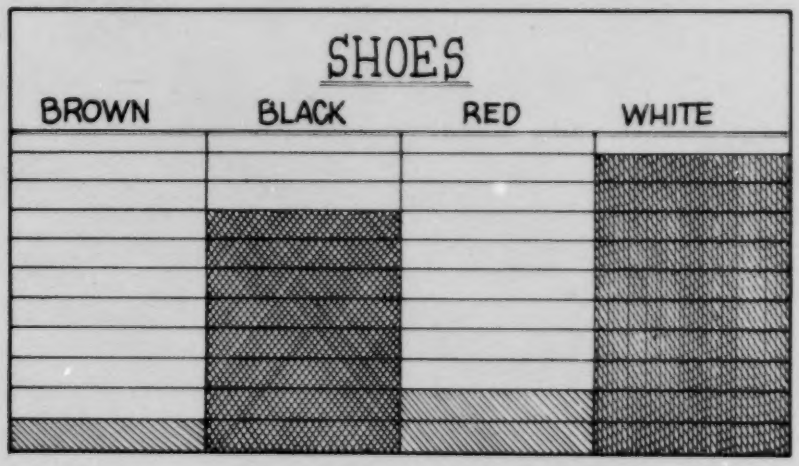


(from Developmental Mathematics, Tulsa Public Schools, 1979, page 43. Used by permission.)

★1-16 OBJECTIVE: Prepare, read and interpret simple bar and line graphs.

ACTIVITIES:

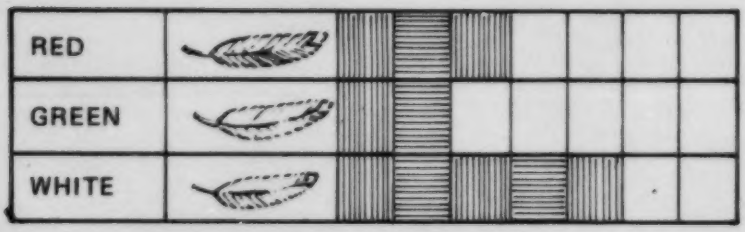
(a) On chalkboard, let children fill in one square for their shoe color (or on other graphs, the color of their eyes, hair, etc.). Bar graph models can be made on the floor using blocks which note how many children go home by bus or bring sack lunches.



(b) Children can record the number of boys and the number of girls present each day on a wall graph made by the teacher. See OBJECTIVE 2-11.

(c) Put assorted feathers in box. Let child retrieve them, separate them by color, count each color then fill in the chart.

Note: This activity can be replicated with other objects.



★ 1-17 OBJECTIVE: Identify spatial relationships between objects.

ACTIVITY: Always utilize opportunities to verbally describe spatial relations between things in the room and the children. For instance, "Sally, pick 'up' the book 'beneath' your worksheet." "Adeline, what is 'behind' those curtains in the story?"

★ 1-18 OBJECTIVE: Introduce and practice addition and subtraction of two-digit numbers without regrouping.

ACTIVITY: Follow "The Ladder of Learning" as shown. In doing so, remember to use concrete things that all have one common trait (e.g. all toy cars instead of cars and trucks; all raisins instead of raisins and peanuts). Also, use small things that can be bagged, boxed or bundled easily into groups of ten.

"The Ladder of Learning" is a four step process. The process can be modified slightly, and used in a wide variety of mathematics learning situations. "The Ladder of Learning" progresses from the concrete to the pictorial to the abstract and features considerable student verbalizing about mathematics.

Step One: Manipulation, Counting, and Discussion
Have the children do many combinations with the concrete objects. They should count out these combinations and discuss the numbers involved. Lead their work into combining situations of 2-digit numbers (like fourteen striped balls and fifteen plain balls).

Step Two: Grouping for Tens
Have the children box, bundle, or bag the objects into groups of ten. Then do some of the original combinations again (like fourteen striped balls and fifteen plain balls). Discuss their work so that the children see they can count faster when some of the objects are grouped into tens.

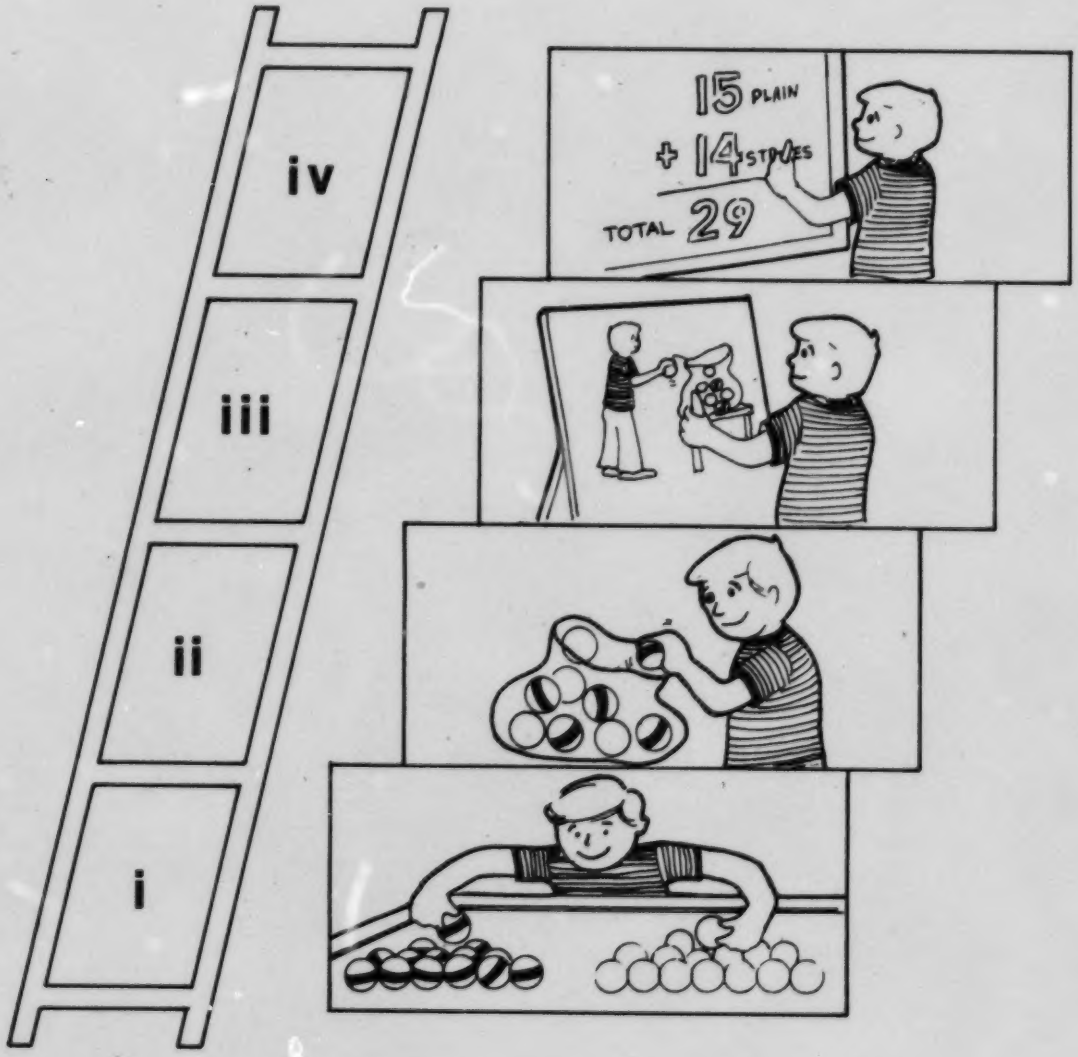
Step Three: Picture the Actions
Have the children draw pictures that represent the combinations they have been doing with the objects . . . especially those with the objects grouped by tens.

Step Four: Write and Read the Equation
Have the children write the equations that illustrate the combinations they have done. Use vertical form.

Note: The same basic activities can be utilized with subtraction as were given for addition. Once again, it is crucial that the children start with concrete objects. The Tulsa Schools suggest using the students to act out subtraction; e.g., a group of seven children to be birds in a nest and three fly away.

When the children are doing some of the 2-digit subtractions without regrouping, try a few examples (with physical objects) where they must regroup and see whether they can decide to un-bag, un-box, or un-bundle.

LADDER OF LEARNING



★1-19 OBJECTIVE: Order objects or pictures of objects in sequence of color, quantity, size, time, etc.

ACTIVITIES:

(a) See K-15

(b) Use a yellow and a blue set of teacher-made cards numbered 1-10. Mix the cards, then have the child sequence them by color and number (e.g. y1, b2, y3, . . . or y1, y2, b1, b2 . . .).

(c) Broken crayolas may be sequenced to size, color, and/or quantity.

41

Grade 2

Grade Two

Objectives

		Page
2-1	Increase student awareness of mathematics in the world..	50
2-2	Count aloud to 999.....	50
2-3	Read and write numerals to 999.....	50
2-4	Describe familiar physical situations in which a one-to-many matching occurs.....	51
2-5	Write numeral in expanded notation.....	52
2-6	Practice counting by 2's, 3's, 4's, 5's, 10's, etc.....	52
2-7	Practice basic addition and subtraction facts for numbers through 12's.....	52
2-8	Introduce the "reasonable fractions" like halves, thirds, fourths, fifths, sixths, eighths, tenths and compare their relative sizes.....	53
2-9	Subtract three-digit numbers without regrouping.....	54
2-10	Solve word problems involving adding or subtracting two-digit or three-digit numbers.....	55
2-11	Prepare, read and interpret simple broken-line graphs...	56
2-12	Find sums and differences using dollars and cents.....	56
2-13	Alert children to the reasonableness of results and relative size of numbers.....	57
2-14	Make and solve simple problems.....	58
2-15	Present the multiplication process and facts for 1's, 2's, 3's, 4's, and 5's.....	58
2-16	Recognize sequence patterns.....	59
2-17	Identify spatial relationships between objects.....	59

★ 2-1 OBJECTIVE: Increase student awareness of mathematics in the world.

ACTIVITY: Together with children prepare several large collages of numbers, shapes, graphs, measuring instruments for display on walls, doors, ceiling, etc.

★ 2-2 OBJECTIVE: Count aloud to 999.

ACTIVITY: As a warm-up or closing activity for several successive days, use this technique. One child begins counting from 1 through a certain number such as 28. The next student begins at 29 and counts on through 46. A third child starts at 47 and so on until the whole class has had an opportunity to count, or a five-minute time limit has been met. Note the last number counted and begin the next day from there. Repeat for successive days until 999 has been reached.

(from Developmental Mathematics, Tulsa Public Schools, 1979, page 59. Used by permission.)

★ 2-3 OBJECTIVE: Read and write numerals to 999.

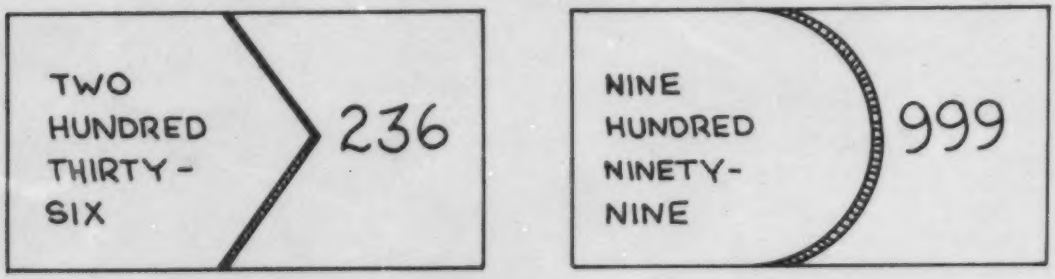
ACTIVITIES:

(a) Prepare and use a transparency like the example chart below. Have students complete similar spirit duplicated charts for numerals up to 999. Students can staple chart sheets together to make "My 999 Book".

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21									

44

(b) Divide class into several groups for a contest on putting together, then reading aloud "word-numeral" puzzles as shown:
Make plenty of them and laminate for long wear.



(c) Pass out worksheets that show short lists of "word-numerals" for matching e.g.

fifty-five	55
four hundred four	500
four hundred forty-four	404
five hundred	444

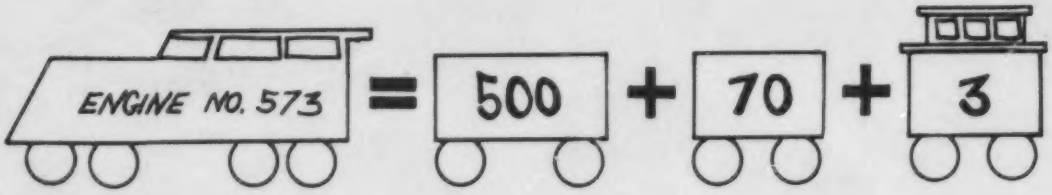
Compile three or four such lists. Also prepare two sections where the words are written and child must write the numerals and two sections where the numerals are written and child must write the words.

★ 2-4 OBJECTIVE: Describe familiar physical situations in which a one-to-many matching occurs.

ACTIVITY: Following teacher examples of "one hand to five fingers" and "one teacher to 23 students", etc., students give other examples aloud for teacher to record on blackboard.

★ 2-5 OBJECTIVE: Write numeral in expanded notation.

ACTIVITY: Prepare a train using the engine as the positional notation and the following cars as expanded notation. This can be used as a bulletin board or as an individual activity by using a series of them placed on a spirit master.



(from Developmental Mathematics, Tulsa Public Schools, 1979, page 61. Used by permission.)

★ 2-6 OBJECTIVE: Practice counting by 2's, 3's, 4's, 5's, 10's, etc.

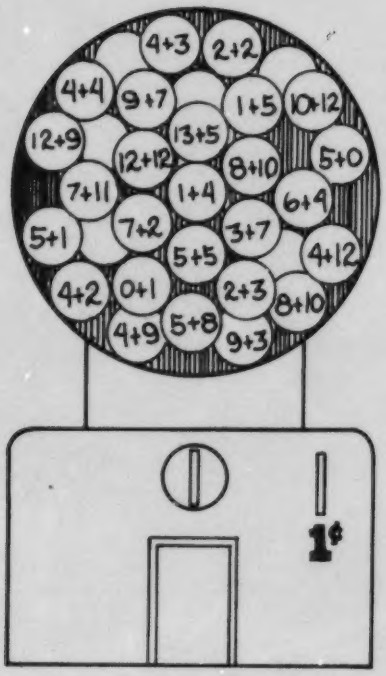
ACTIVITY: Instead of assigning all computational exercises on a page or worksheet, have the children do only the evens, or the multiples of 3, etc. (count them aloud with the class and have them circle the exercises as you count).

★ 2-7 OBJECTIVE: Practice basic addition and subtraction facts for numbers through 12's.

ACTIVITIES:

(a) See OBJECTIVES 1-6 and 1-7.

(b) Use the Bubble Gum Machine Game for small groups at a table. Each child lightly tosses a penny into the large circle. If the penny lands on a circle, the child must solve the problem correctly for 5 points (if incorrect, gets only 1 point). If the penny lands between circles or misses altogether, the child tries again.



(c) Give timed speed tests daily during first 5 minutes of mathematics session. Children can graph their scores on 1 cm. block graph paper.

(d) Record the basic addition, subtraction and multiplication facts on cassettes with the children from your class providing the voices. Keep cassettes for group and individual drill and practice.

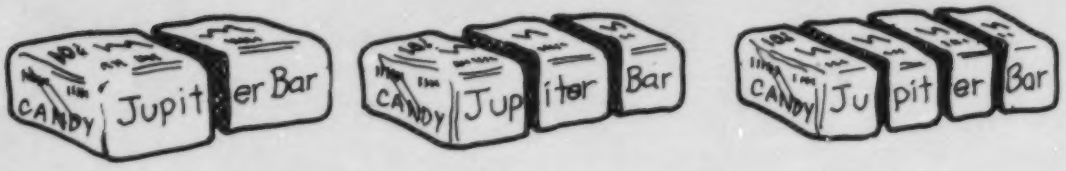
★2-8 OBJECTIVE: Introduce the "reasonable fractions" like halves, thirds, fourths, fifths, sixths, eighths, tenths and compare their relative sizes.

ACTIVITY: Have a "Fraction Fiesta" with the help of the children's parents. Provide items like: pizza pies cut into sixths and eighths; oranges and apples cut into halves and fourths; fruit pies cut into thirds, then sixths; half cups of juice; sheet cakes cut into tenths.

Notes:

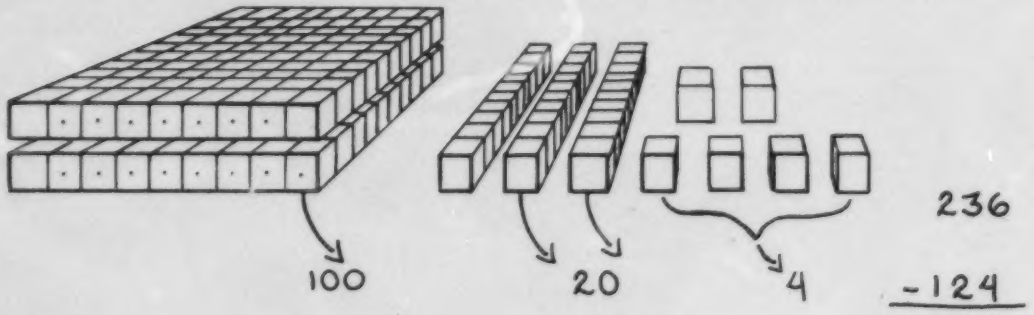
i) It is crucial that this activity be followed with review demonstrations and worksheets with numerous diagrams that illustrate different representations of each fraction.

ii) Another alternative activity is to concentrate work on a group of identical things (like a dozen of one kind of candy bar). Then cut each candy bar differents ways to illustrate different fractions.



★ 2-9 OBJECTIVE: Subtract 3-digit numbers without regrouping.

ACTIVITY: Make or purchase enough "number system counters" as illustrated so that students can work in groups of four and count out actual subtraction problems. For example:



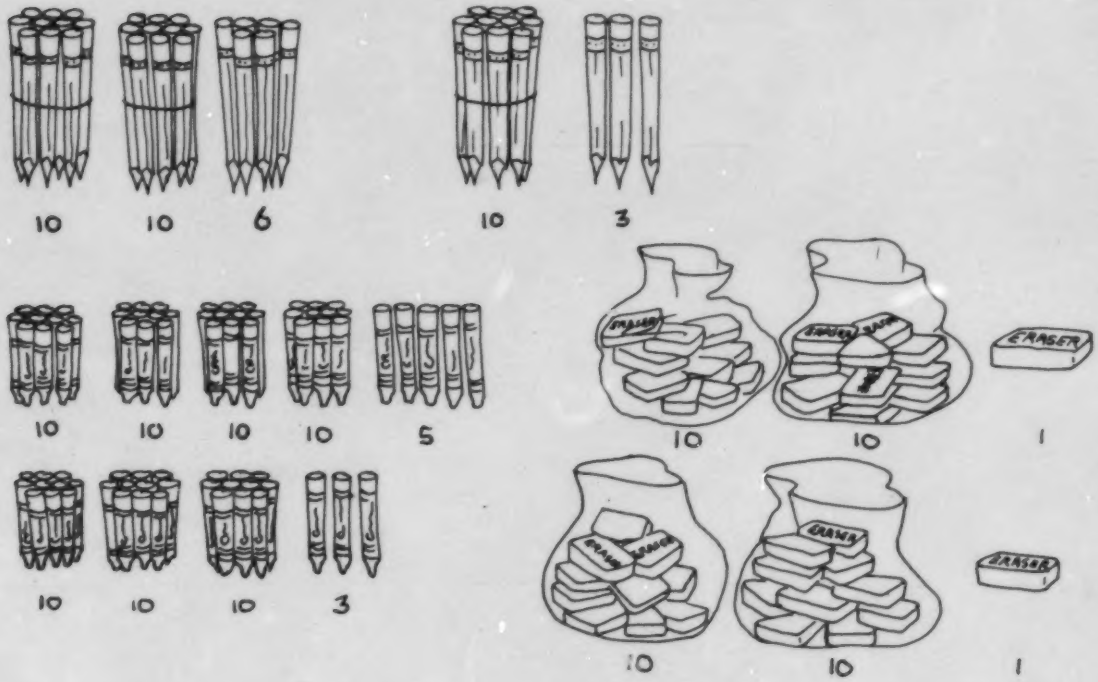
Provide each group with a worksheet on which they can draw a picture of their problem and write the correct subtraction equation.

Note: Of course these same "number system counters" should have been used when children were introduced to 3-digit addition earlier in the year as well as in doing 2-digit addends with regrouping.

48

★ 2-10 OBJECTIVE: Solve word problems involving adding or subtracting 2-digit or 3-digit numbers.

ACTIVITY: On overhead transparency, prepare a pictured list of items such as:



Ask children to tell a story for the pictures and write a number sentence that fits the story.

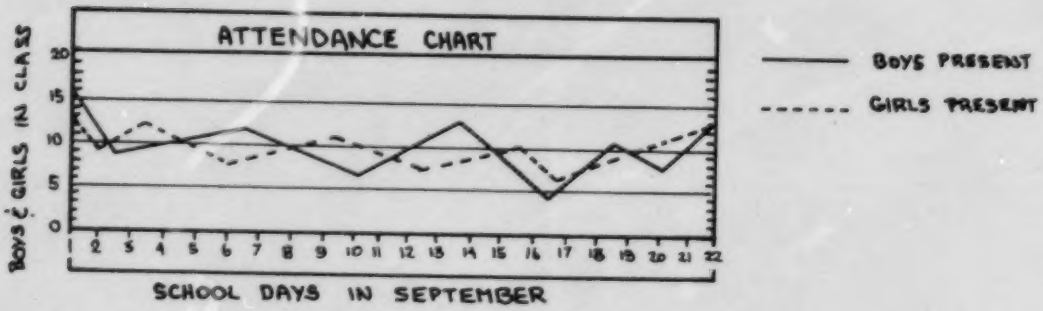
Follow through with a hands-on activity where each child adds the bundles of crayons and the single crayons to check accuracy.

Note: This same activity can be used to demonstrate addition and subtraction of 2 or 3 digit numbers with regrouping.

★ 2-11 OBJECTIVE: Prepare, read, and interpret simple broken-line graphs.

ACTIVITY: On the wall, maintain a large graph that illustrates the number of boys present each day (solid line) and the number of girls present each day (dotten line).

Construct other graphs showing the number of children walking to school and the number riding the bus; or the number of students bringing their own lunches and the number eating cafeteria lunches.



★ 2-12 OBJECTIVE: Find sums and differences using dollars and cents.

ACTIVITIES:

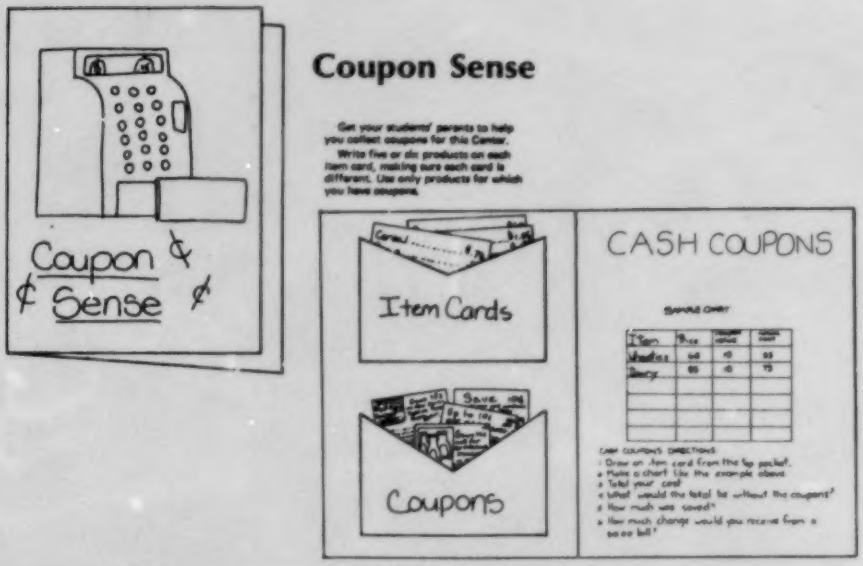
(a) Distribute real coins to groups of three to four students. Have students determine the kinds of coins and the number of each kind needed for a given amount of money. Require students to record their results and then, arrive at the fewest numbers of coins needed to make the given amount of money. For example:

17¢ = 17 pennies
= 3 nickels and 2 pennies
= 1 dime + 1 nickel + 2 pennies

56¢ = 5 dimes and 6 pennies
= 5 dimes + 1 nickel + 1 penny
= 2 quarters + 1 nickel + 1 penny

50

(b) Construct a "Coupon Sense" file folder as shown:



(from Centers Galore, page 86; used by permission of the Education Center)

★ 2-13 OBJECTIVE: Alert children to the reasonableness of results and relative size of numbers.

ACTIVITIES:

(a) Later in the year, intentially do some addition problems wrong at the blackboard. Something like 12 + 32 = 735 will get the children's attention. Discuss with them why that answer "sounds silly". Offer some other "silly answers" that are somewhat closer to the correct answer. Continue discussion and lead children to idea of "just about right".

(b) Perform variations on the "How many beans in a jar?" contest. Use match box size containers and beans and ask the students to estimate, then count the number of beans. Repeat with ideas like "How many desks could we put in the room? . . in the hallway?" or "How many crayons in this little bag? . . in the medium sized bag?" These situations should lead to some lively discussions about counting and measuring. The situations could be summarized nicely in a "Guess Then Find Out Center" where children are provided more materials and

worksheets with similar questions.

★ 2-14 OBJECTIVE: Make and solve simple problems.

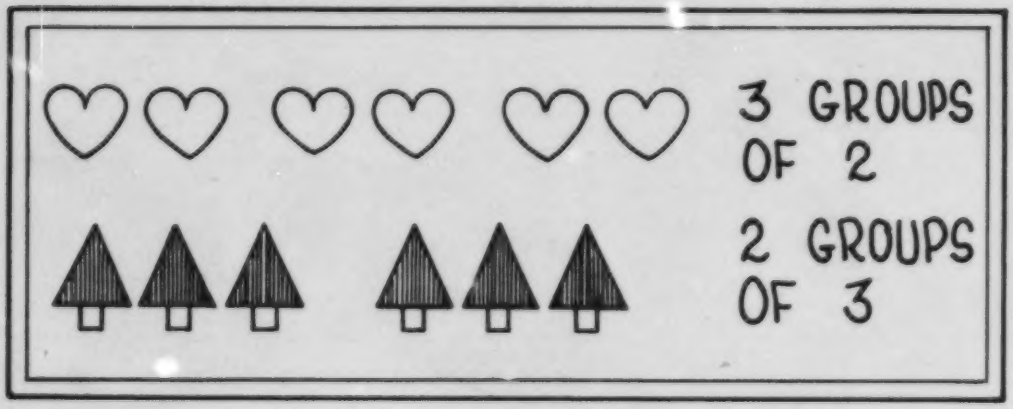
ACTIVITY: On blackboard or spirit master, list some favorite and nutritious foods and current costs, e.g., apple 20¢, peach 25¢, banana 15¢, milk 20¢, peanut butter and jelly sandwich 25¢. Have students select what they would like for a snack and total the cost. Have each student also decide what to buy and how much (if any) change would be returned from 75¢.

★ 2-15 OBJECTIVE: Present the multiplication process and facts for 1's, 2's, 3's, 4's, and 5's.

ACTIVITIES:

(a) Provide children with many opportunities for grouping and counting real objects like "three groups of two books each" or "two groups with five tomatoes in each group". Discuss different ways to find out the total number of books or tomatoes, etc. Picture the action. Write the equations.

(b) Use pictures on a magnetic flannel board to reinforce the idea of multiplication as continuous addition.

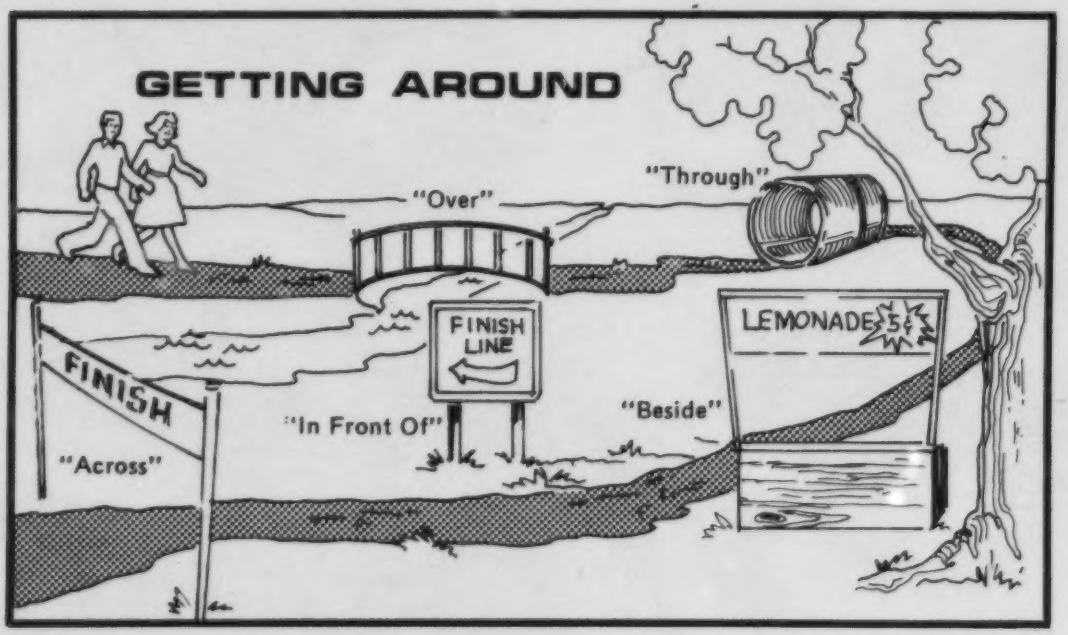


★ 2-16 OBJECTIVE: Recognize sequence patterns.

ACTIVITY: Sequence Relay.
The teacher starts the sequence by writing the first three numbers on the board then the race begins. The first runners go to the board and write the next numbers in the sequence, return and give chalk to the next runner. If an error is made, the teacher erases it, and the next runner records the correction. Example: 3,6,9, or 1,2,4, or 90,85,80, etc.

★ 2-17 OBJECTIVE: Identify spatial relationships between objects.

ACTIVITY: Prepare bulletin boards on spatial relationships as follows:



Grade 3

Grade Three

Objectives

		Page
3-1	Read a numeral to 1,000,000	64
3-2	Write numerals for number words through 1,000,000	65
3-3	Recognize even and odd numbers	66
3-4	Use symbols "<" or ">"	66
3-5	Round numerals to nearest tens	66
3-6	Practice addition facts up to 12's and corresponding subtraction facts	68
3-7	Find sums of three-digit numbers with or without regrouping	69
3-8	Measure the temperature and indicate rise and fall	70
3-9	Read and write time to the minute	70
3-10	Solve "word problems" that may involve addition of two 3-digit numbers with regrouping or may involve other computational skills	71
3-11	Solve "money problems" that use dollars and cents less than $500	72
3-12	Demonstrate the "order property of addition" (i.e. the commutative property of addition)	72
3-13	Introduce multiplication with several word problems	73
3-14	Practice basic multiplication facts	74
3-15	Illustrate basic multiplication facts	74
3-16	Solve multiplication problems with regrouping	76
3-17	Use money and recognize the value of the following coins: penny, nickel, dime, quarter, and half-dollar	76
3-18	Recognize and draw line segments, lines, rays and other geometric shapes	77
3-19	Identify fractions and equivalent fractions	77
3-20	Recognize that water freezes at 0°C and boils at 100°C	77
3-21	Prepare, read and interpret charts and graphs	78

★3-1 OBJECTIVE: Read a numeral to 1,000,000.

ACTIVITIES:

(a) Use a spinner with numerals 0, 1, 2, . . ., 9 as illustrated. Have student spin it six times to get six numerals. Student then should arrange numerals to produce (1) largest number, (2) smallest number, (3) many combinations in between. Student reads number aloud to teacher or partner.

(b) Prepare a mountain as illustrated on the opposite page. Each section of the mountain will account for a certain place value with the larger numbers forming the base.

Have six envelopes, each containing numerals written on puzzle shapes, for appropriate sections of the mountain.

(i.e. one envelope with mountain tops)

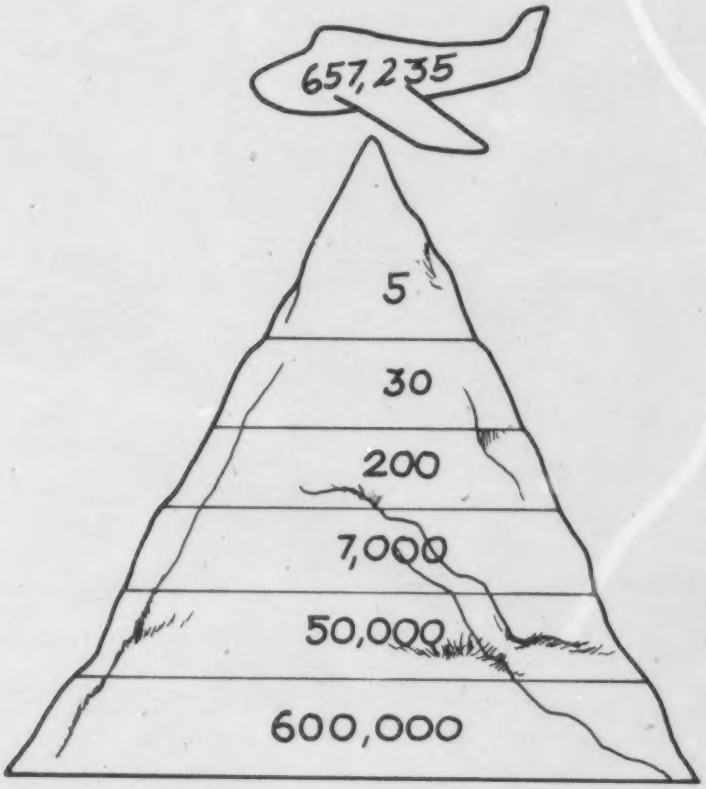
(one envelope with mountain bases)

Student chooses one piece from each envelope and fits over blank mountain then fills in completed number on airplane. Student concludes activity by reading aloud the number written on the airplane.

★ 3-2 OBJECTIVE: Write numerals for number words through 1,000,000.

ACTIVITY: Follow up on the "mountain" concept by preparing spirit handouts of blank "mountains". Read a number aloud to the students, for example: (six hundred fifty seven thousand, two hundred thirty-five.)

Student expands the number on the mountain in "place value form". Then writes entire number on airplane in positional notation.



★3-3 OBJECTIVE: Recognize even and odd numbers.

ACTIVITY: Use toothpicks to illustrate each number. Divide students into pairs and give each student equal amounts of toothpicks. Each pair makes the even numbers first (e.g. 2, 6, 10, 14, 22) by putting down toothpicks in turn. Then each pair makes the odd numbers (e.g. 1, 3, 17, 25). Students should notice that going "in turn" for the odds "is not fair" (i.e. one student gets an extra turn).

List the even numbers studied on one half of the blackboard and the odd numbers on the other half. Draw students' attention to the ones place as the key to determining odd or even.

★3-4 OBJECTIVE: Use symbols " < " or " > ".

ACTIVITY: Choose any two numbers up to 1,000,000. Student writes each number in expanded notation, vertical form. Student determines correct inequality sign by comparing place value of each number from left to right. For example:

90,286 =	90,000	equal	90,183 =	90,000
	200	greater than		100
	80	doesn't matter		80
	+ 6	doesn't matter		+ 3
so,	90,286	>		90,183

34,628 =	30,000	equal	34,631 =	30,000
	4,000	equal		4,000
	600	equal		600
	20	less than		30
	+ 8	doesn't matter		+ 1
so,	34,628	<		34,631

★3-5 OBJECTIVE: Round numerals to nearest tens.

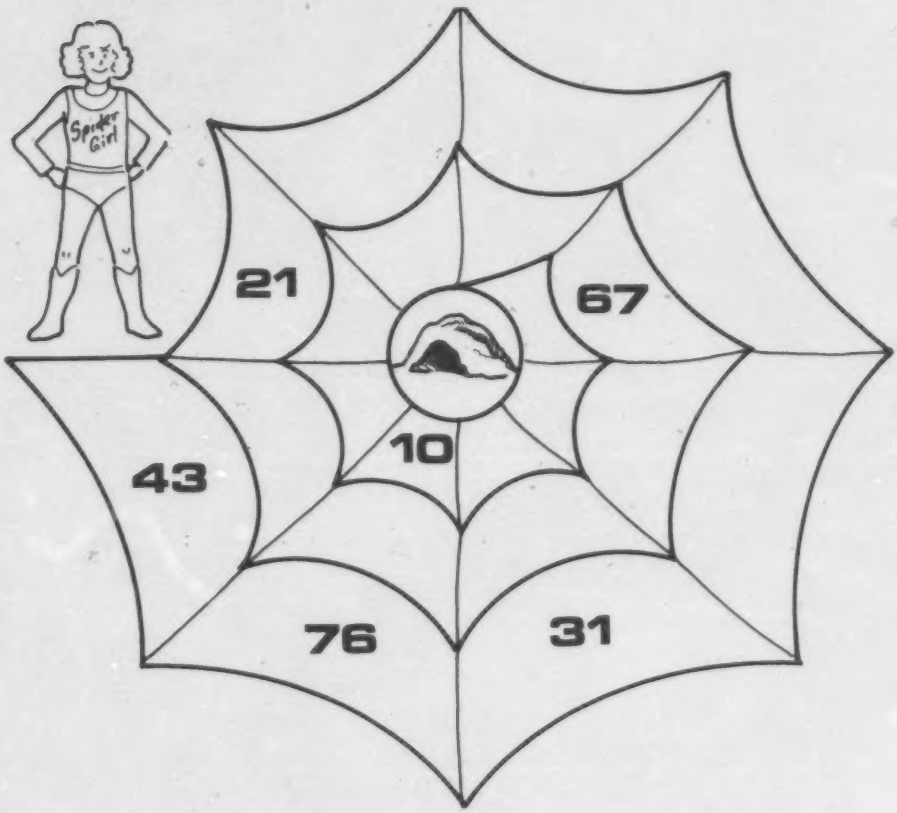
53

ACTIVITIES:

(a) Write a numeral on the board, for example 48. Have students give the multiple of ten just above 48 and the multiple of ten just below it. Record vertically like this 50
48
40. Ask students if 48 is closer to 40 or 50. Repeat with many examples like 62, 19, 33, 85, etc. and attempt to develop the "rule".

When the "rule" is developed have students copy it down in their notebooks along with some examples that illustrate the rule.

(b) Help "Spider Girl" to get to her cave quickly. In each space, place a number to be rounded. Provide laminated pictures of a red, blue, green, etc. "Spider Girl" so each player has one. Use a spinner to determine who goes first and for how many spaces. When a player lands on a space, round the number to the nearest tens. If a player rounds incorrectly, they must return to original position.



(c) Conduct speed contests for adding three or more two-digit numbers. Number students 1, 2; 1, 2; 1, 2; etc. Have the 1's estimate their answers (by rounding off) and 2's work long way. (Each group should show their work.) For example:

Problem		Rounded	Worked by Usual Addition
46	≈	50	46
24	≈	20	24 + 70
+32	≈	+30	32 32
		100	102

(If students can use rounding off rule quickly, 1's will win generally, thereby, illustrating importance of estimation.)

★ 3-6 OBJECTIVE: Practice addition facts up to 12's and corresponding subtraction facts.

ACTIVITY: Prepare frogs and lily pads as illustrated below. Make frogs with addends like 6 + 7, 8 + 9, 11 + 12, 12 +11, i.e., each addend should be greater than five. Make lily pads for each sum 12, 13, 14, . . ., 24. Student is to place each frog on lily pad that is the sum of its addends. Laminate the frogs and the lily pads so they can be used for a long time.

60

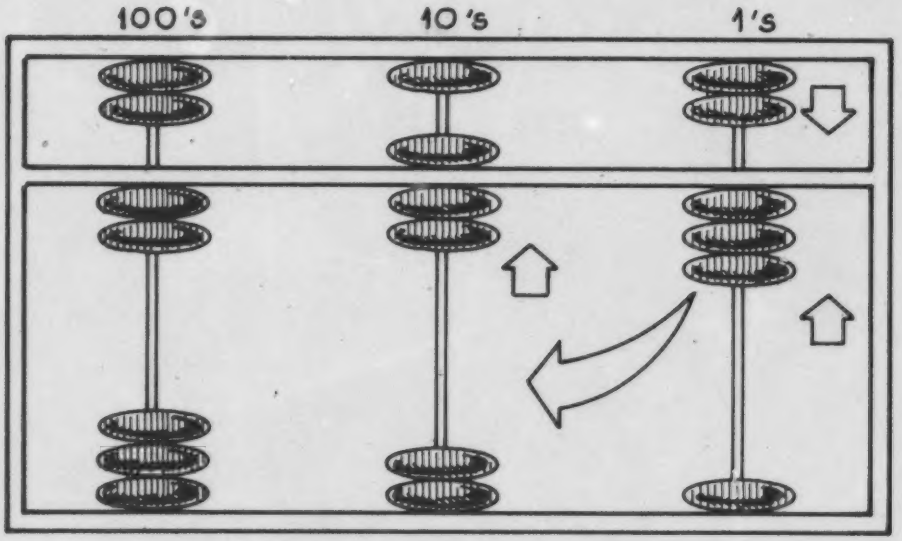
Notes:

i) By third grade most students will have had considerable practice with the addition facts for sums up to 12. Many may still need a lot of practice with the facts whose sums are 13 to 24.

ii) By making frogs labeled 12 - 8, 11 - 3, 13 - 5, 15 - 7, etc. and lily pads for correct differences this activity can be extended to subtraction . . . What should be changed so as to use it for multiplication and division facts?

★ 3-7 OBJECTIVE: Find sums of three-digit numbers with or without regrouping.

ACTIVITY: Make an abacus. Use any size box. Make beads out of play dough and paint if commercial beads are not available. Use colored beads according to place value. Place beads on some string or yarn across width of box. Partition between the unit beads and the fives beads.



To use the abacus, remember:

i) Each bead on the wide side of partition equals one unit of each place value, whereas, each bead on the narrow side equals five units of the given place value.

ii) Counting consists of moving the correct combination of beads to the dividing partition.

Notice that in the illustration the abacus is set at 273, two unit beads in the hundreds place are at the partition. A five unit (5 x 10 = 50) and two unit beads are at the partition in the tens place. Three unit beads are at the partition in the ones' place.

What is 273 + 126? Move a five unit and a unit bead to the partition in the ones place. Move two unit beads to the partition in the tens place. Move one unit in the hundreds place.

★3-8 OBJECTIVE: Measure the temperature and indicate rise and fall.

ACTIVITY: Have the students record the temperature twice a day. Record the difference in temperature and whether it was an increase or decrease.

DAYS	MORNING TEMPERATURE	AFTERNOON TEMPERATURE	DIFFERENCE	RISE OR FALL
MONDAY	30°	65°	35°	RISE
TUESDAY	40°	35°	5°	FALL

★ 3-9 OBJECTIVE: Read and write time to the minute.

ACTIVITY: Construct a clock on the bulletin board. Ask a variety of time questions on separate cards (i.e. show 2:10 on the clock, etc.). Have one student show the time using the clock while the other students

write the time on their papers.

★3-10 OBJECTIVE: Solve "word problems" that may involve addition of two 3-digit numbers with regrouping or may involve other computational skills.

ACTIVITY: Prepare problem ditto sheets similar to the following. Design various problems using several computational skills and different levels of difficulty from one situation.

Miles Each Day	
Friday	378 miles
Saturday	425 miles
Sunday	396 miles
Monday	313 miles

The Smith's drove to Oregon to visit some friends. It took them 4 days to make the trip. Lisa Smith wrote down how far they traveled each day.

(a) How far did the Smiths drive the first two days of their trip?

(b) How much farther did they travel on Sunday than on Monday?

(c) On Saturday morning they traveled for 4 hours without stopping. They drove 55 miles an hour. How many miles did they drive on Saturday morning?

(d) The Smith family drove a total of 36 hours during the 4-day trip. They drove the same number of hours each day. How many hours did they drive each day?

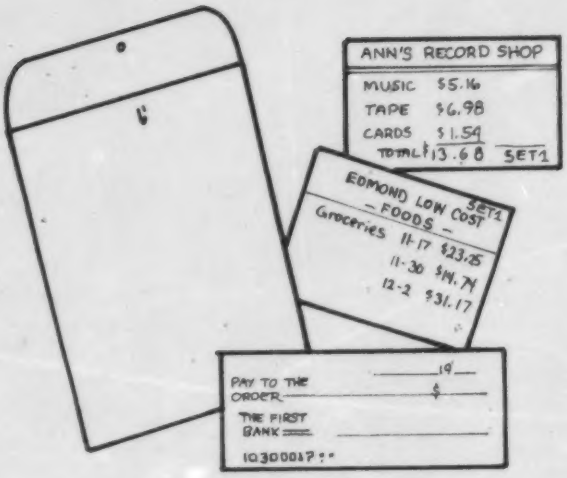
(e) How many miles did they travel during 4 days ?

(f) How much farther did the Smith family drive the first two days of their trip than the last two days?

★3-11 OBJECTIVE: Solve "money problems" that use dollars and cents less than $500.

ACTIVITY: Secure voided demonstrator checks from a local bank or prepare your own. Place checks, some "bills" and a balance sheet in an envelope for each student (supply enough extra so those students who finish early may do a second).

Note: To save time, record only the final balance for correction. If student's final balance does not agree with correct final balance, student must review bills and checks to find error.



SET 1

DATE	DESCRIPTION	PAYMENT	BALANCE
			$120.42
11-17	ANNS RECD SHOP		$126.12

★3-12 OBJECTIVE: Demonstrate the "order property of addition", i.e., the commutative property of addition.

ACTIVITIES:

(a) Have students manipulate some objects like pencils, crayons, pieces of candy, etc., to show 3 things plus 4 things. Then they should compare the answer to 4 things plus 3 things. Repeat with many objects and varying quantities (use number above 10). Write equations on blackboard.

The aim is for students to see that the order in which addends are written does not effect the outcome (providing one adds carefully).

64

(b) Prepare a chart as follows:

Order of action does not change result	Order of action changes result
Addition e.g. 8+7 = 15 7+8 = 15	Subtraction 8-7 = 1 7-8 = ??
Putting on a coat and a hat	Putting on shoes and socks

Talk with children about daily actions they do which may fit on one side of the chart or the other (e.g. taking off pajamas then getting dressed).

★3-13 OBJECTIVE: Introduce multiplication with several word problems.

ACTIVITY: Pose a problem like "How many oranges do we need if we want each person in our room to have three?" Develop the problem using real oranges. Illustrate with a picture. Discuss the process of "three plus three plus three plus three . . ." for the number of persons in the room. On the blackboard, record this process of repeated addition and the "fast way" we have developed for writing it.

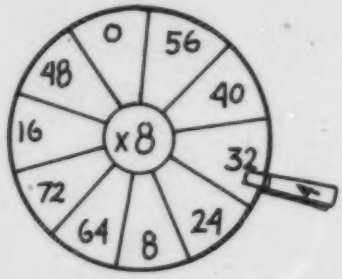
Repeat with many examples and have students record in their notebooks.

Have students make up their own "word problems" for different multiplication facts.

★3-14 OBJECTIVE: Practice basic multiplication facts.

ACTIVITY: Make a multiplication circle as shown below, for each of the basic multiplication facts up to 12's. Place answers on back. Cover circles with contact paper. Label ten plastic or wooden clothespins with a numeral 0,1, 2, . . ., 11, 12.

Student must choose a clothespin and clip it to the correct sector of a circle to show a true multiplication fact.



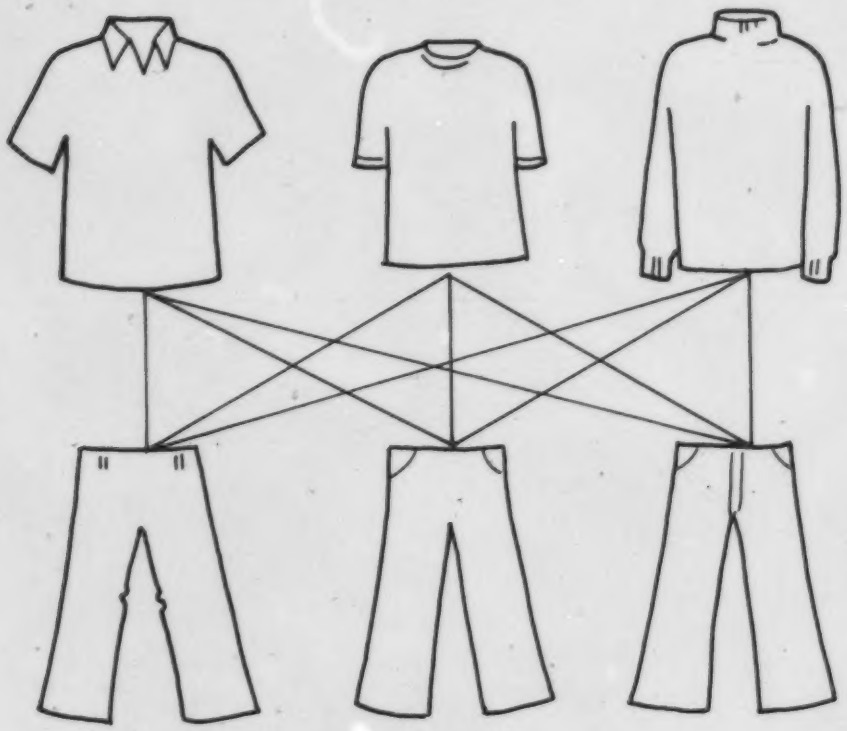
★3-15 OBJECTIVE: Illustrate basic multiplication facts.

ACTIVITIES:

(a) Together with students, fill in a chart like the one below to illustrate "2's Time Table". Use pictures of tricycles for the 3's, wagons for the 4's. How about fingers for the 8's?

1 Person =	2 Feet	6 People =	Feet
2 People =	Feet	7 People =	Feet
3 People =	Feet	8 People =	Feet
4 People =	Feet	9 People =	Feet
5 People =	Feet	10 People =	Feet

(b) Bring three different slacks and three different tops to class and demonstrate making nine possible outfits as shown.



★3-16 OBJECTIVE: Solve multiplication problems with regrouping.

ACTIVITY: Help New Orlean's notorious pirate Jean Lafitte count his treasure. First, estimate the amount of gold in each bag. Then, total the products you estimated. Next, compute the exact products and total them. Which amount was the largest?

★3-17 OBJECTIVE: Use money and recognize the value of the following coins: penny, nickel, dime, quarter, and half-dollar.

ACTIVITY: Have the students set up a school store where a variety of items can be bought. Two or three students will operate the store while the rest of the students shop. Play money is used to buy the objects.

This can be expanded to include a whole community where different services provided by the students, are paid for with play money.

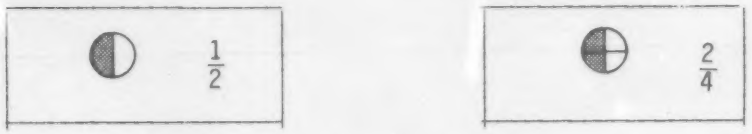
★3-18 OBJECTIVE: Recognize and draw line segments, lines, rays and other geometric shapes.

ACTIVITY: Make flash cards showing various geometric shapes. Students can practice with cards in pairs or larger groups.

★3-19 OBJECTIVE: Identify fraction and equivalent fractions.

ACTIVITY: Make two decks of cards. Show fractions on one deck and the corresponding pictures on the other deck.

Cards can also be made to show equivalent fractions using pictures and fractions.



Students play a game of matching or rummy by making pairs that match.

★3-20 OBJECTIVE: Recognize that water freezes at 0^{o} C and boils at 100^{o} C.

ACTIVITY: Have several containers of ice and water so that students can work in small groups. Provide enough Celsius thermometers for four to five groups.

Have students place thermometer in container of water and record temperature, then place thermometer in container of ice and record that temperature (after a minute).

Boil water for students and have them measure temperature as boiling begins.

★ 3-21 OBJECTIVE: Prepare, read and interpret charts and graphs.

ACTIVITIES:

(a) See OBJECTIVES 2-11 and 4/6-20 and 4/6-21.

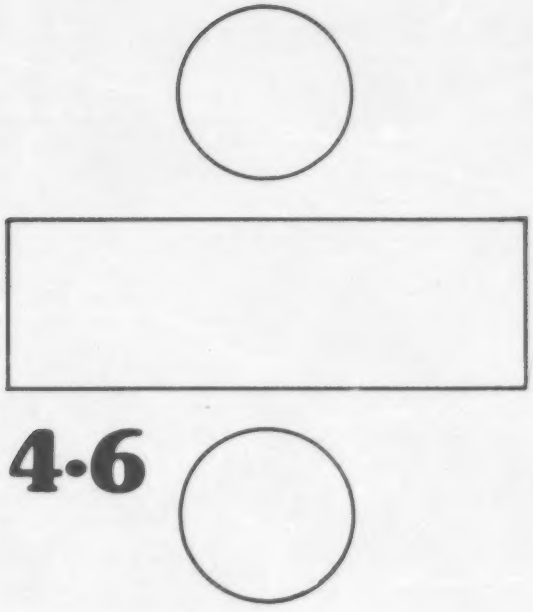
(b) Undertake a class project of hatching chicks. Borrow a twenty-four egg incubator from the County Extension Service. Use a small scale graduated in grams or ounces and weigh the eggs daily. Number each egg on the outside. Complete a chart like this:

EGGS	DAY 1 TEMP. 86° WEIGHT	TURNED	DAY 2 TEMP.___ WEIGHT	TURNED
1	2 3/4 oz.	x		
2	2 1/4 oz.	x		
3	4 oz.	x		
4				
5				
6				
7				
etc.				

After chicks are hatched, they should be kept in the classroom for three or four days. Use a large cardboard box and gooseneck lamp to keep the chicks warm. From a local feed store, obtain a very inexpensive feeder, water dish and a small amount of food for the short period chicks will be in the room.

70

Secure parents' written permission for children to take chicks home. Discuss "Care of a Pet" in class and send home care instructions as well as a good supply of food for a few days.



Grades 4-6

Grades 4 — 6

SPECIAL COMMENTS

Grades four through six provide special challenges as well as special opportunities for the teaching and learning of mathematics.

In most schools, the mathematics curriculum is extended and deepened considerably during these years. Students generally, will be introduced to, and be expected to compute and apply decimals, percents, ratio and proportion, exponents, and simple square roots. Students will also be expected to add, subtract, multiply, and divide with whole numbers up to trillions as well as with fractions and mixed fractions where denominators can be any whole number less than 1000. Students will also be expected to read, interpret, and construct more eleborate charts and graphs; to define and use more geometric terms; and to measure with greater precision.

Therefore, teachers are challenged to "cover all this material" and still provide enough "hands-on" experiences so that the students develop clear conceptual frameworks. And, for the students, a major challenge is remembering information, such as when to keep decimals in a straight line, or when to count up the total number of decimal places, or when to find a common denominator.

Requiring students to prepare and maintain mathematics notebooks for grades four through six, may help meet both challenges. Mathematics notebooks have proven effective in many schools because students can personally record how to solve given exercises, definitions of new terms, or rules like rounding off. These notebooks are not lost as easily as single sheets of classwork or homework exercises.*

They can also be collected at the end of the school year and passed on to the teacher in the next grade so that the total number of weeks spent reviewing in the fall probably will be reduced. These notebooks also should be used as study guides for review before tests and perhaps, even during an occasional open book test. As encouragement for keeping a neat and complete notebook, the teacher should write in positive comments while glancing over them frequently. Also, collecting them at least once each marking period for a thorough checking, will emphasize their importance to the students. The notebooks could be graded and averaged in a

*Some students frequently lose things. Teachers should not allow these students to take their notebooks from class until they demonstrate more responsible habits.

special homework project or quiz grade. Perhaps high quality ones could be recognized with special awards for additional motivitation.

Another way to meet the challenge of "covering all this material" and retaining the previous learning may be a voluntary summer homework project. The Norman schools conducted such a program in the summer of 1980 and were pleased with the results. Self-checking packets of exercises, puzzles, challenge problems and mathematical games were prepared for each grade level. The packets used only topics covered and skills acquired for the given year. Parents were informed of the nature of the program and the requirement to pay for the printing of the packets. Certificates of participation were provided for those students who returned their packets at the end of the summer. (For more information on this program contact Jaci Lovett, Mathematics Specialist, Norman Public Schools.)

A second major challenge for teachers in grades four through six is the motivation of learners with regards to mathematics. Obviously, there are no panaceas for this challenge. Motivating learners probably has been of concern to teachers since before recorded history. There are, however, a few considerations that if acted upon will help teachers meet this challenge.

1. Be enthusiastic about the teaching and learning of mathematics and expect the students to feel and act likewise. Most students will meet this expectation.

2. Develop an atmosphere where questioning and risk-taking are equally as important as answer finding.

3. Work closely with students to determine their levels of competency in mathematics and design realistic short-term and long-term goals for increasing that competency. Then, closely monitor progress towards these goals and provide substantial reinforcement for each student's progress.

4. Utilize the activities described in this publication or similar ones within a systematic program activity, discussion, recording, reviewing and practicing.

A third major challenge for teachers in grades four through six is how to incorporate all aspects of the Basic Mathematical Skills (as discussed in the section on Current Developments and Possible Directions) into an already crowded curriculum and teaching schedule. Again, some of the activities described in this booklet may help spur new approaches for teaching applications and computational skills together rather than allocating separate time for each. In addition, it would be worthwhile for school personnel concerned with mathematics to set a year-long project of reviewing the curriculum and current instructional practices. The

end result of this project would be the identification of the basic mathematical skills in an appropriate scope and sequence. (The Mathematics Specialist with the Oklahoma State Department of Education is available to assist in such a review.)

But what of the special learning/teaching opportunities for the teachers and students during these intermediate years? As students progress into later childhood and pre-teen years, they become more interested and capable of project work. Upper elementary teachers traditionally have used extensive project work in social studies and science. This mode of teaching/learning can be used effectively in mathematics too. Student groups can prepare bulletin boards on special topics like "Computers in the World" or on particularly difficult computational algorithms such as "Our Mission, Conquer Division". Students can conduct classroom surveys or even school-wide surveys for first hand exeprience with "Using Mathematics to Predict".

Also, because of increased language facility and tolerance for ambiquity, students in grades four through six deal more effectively with multi-step problems situations and with problems for which no single soultion exists. Therefore, as teachers, we need not be selective in our choice of problems. . . in fact, we must be sure to provide a variety of problems that can challenge students of all ability levels.

Objectives

		Page
4/6-1	Read large whole numbers	88
4/6-2	Add large whole numbers	88
4/6-3	Construct common geometric solids	89
4/6-4	Practice basic facts	90
4/6-5	Round a whole number to any given place value	92
4/6-6	Consider relative costs of products and services	92
4/6-7	Develop a "Problem Solving Center"	93
4/6-8	Multiply with a different algorithm	94
4/6-9	Bring mathematics "into the home"	94
4/6-10	Practice long division with one-digit or two-digit divisors	96
4/6-11	Use and alternate long-division algorithm	96
4/6-12	Compare a whole with its fractional parts	97
4/6-13	Identify equivalent fractions	98
4/6-14	Relate mathematics to social studies	99
4/6-15	Compute with decimals and solve problems with decimals	100
4/6-16	Drill on finding Least Common Denominator, Greatest Common Factor	101
4/6-17	Calculate commissions	102
4/6-18	Estimate then measure lengths, areas, volumes, masses, temperatures	102
4/6-19	Motivate and review	103
4/6-20	Interpret information from graphs and use graphs to make predictions	104
4/6-21	Prepare figure, bar and broken-line graphs	105
4/6-22	Solve assorted money problems	106
4/6-23	Practice estimation	107
4/6-24	Extend awareness of spatial relations in two dimensions	108

★ 4/6-1 OBJECTIVE: Read large whole numbers.

ACTIVITY: Use three different colors of construction paper (one color for each period: hundreds, thousands, millions). Make nine cards of each color and write a numeral 0-9 on each card. Put the cards in boxes, one box for each color. Draw nine lines on the chalkboard as follows:

_____ _____ _____, _____ _____ _____, _____ _____ _____

Have each student make a copy of the lines on paper.

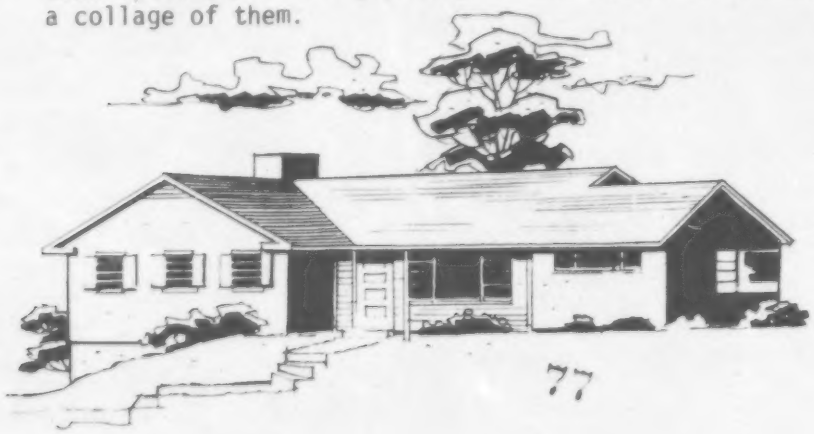
Draw a digit from one box. Each student should write that digit in any blank within the correct period. Once placed, it cannot be changed. Return the card to the box then pull a card from another box. Follow this procedure through a total of nine digits, three of each color.

Then have students read their numbers. Winners could be students with largest or smallest number, or number that is a multiple of 4 or 7, etc.

Adapt for higher grades by adding billions and trillions periods.

★ 4/6-2 OBJECTIVE: Add large whole numbers.

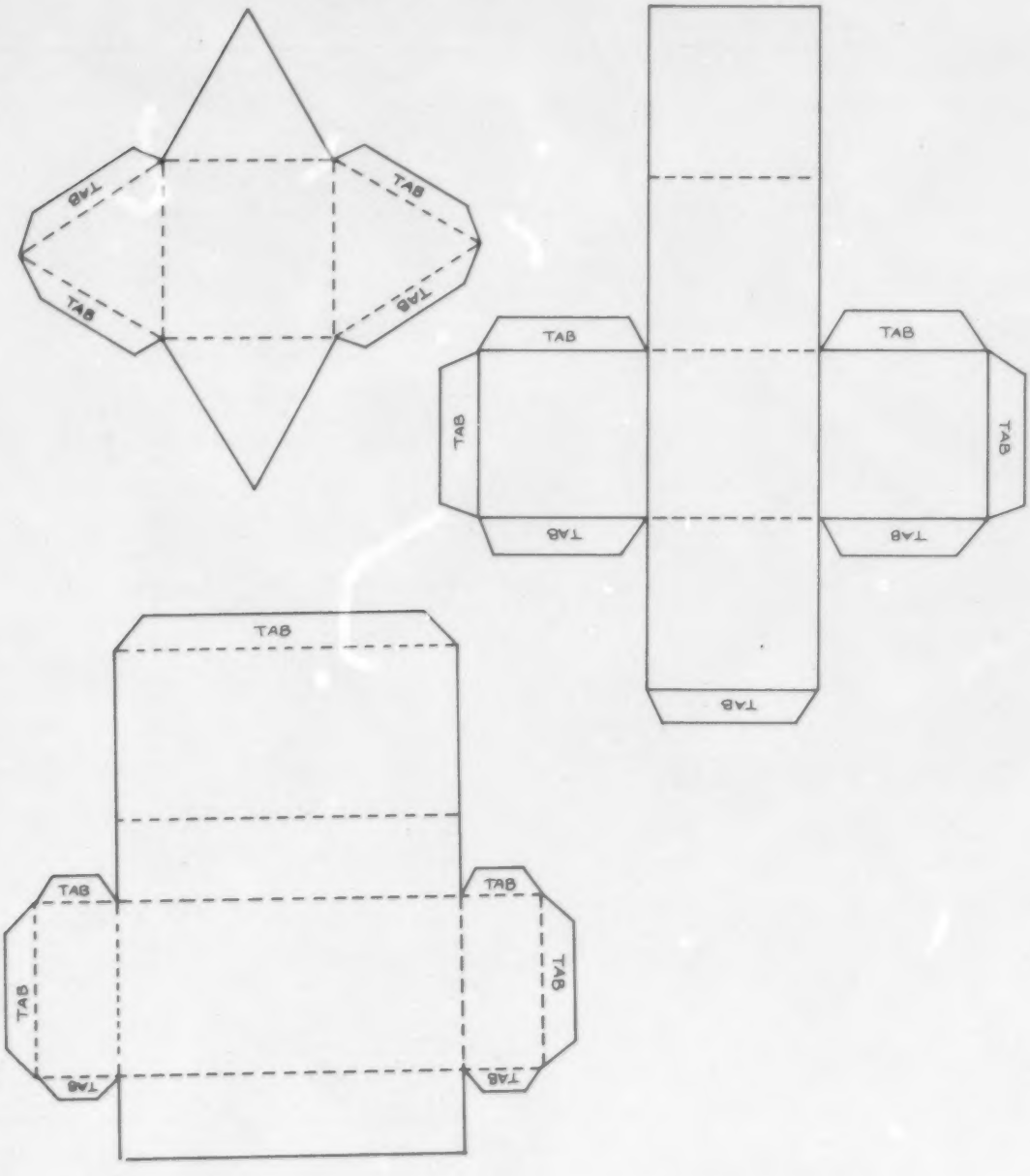
ACTIVITY: Contact realtors in your town and ask them to save their outdated manuals for you. Each student will pretend to be a realtor seeking membership in the "One Million Club", i.e. the student must select houses to sell so that the total of selling prices equals one million dollars. Have each student cut out the descriptions (including price) of the houses chosen and make a collage of them.



77

★4/6-3 OBJECTIVE: Construct common geometric solids.

ACTIVITY: Use construction paper or manilla folders and have each student cut out and assemble the following geometric solids. Prepare an exhibit of these and assign students to seek out and make more elaborate ones for extra credit.



★4/6-4 OBJECTIVE: Practice basic facts.

ACTIVITIES:

(a) Cut out the 16 squares shown. Have students fit them together so that the edges that touch name the same number.

Prepare similar squares for addition, multiplication and division with whole numbers, fractions or decimals . . . . . or for calculations with exponents and square roots of the perfect squares.

10-5 6 9-1 8-1	8 10-7 15-5 12-2	9-4 5	11-2 2
6 6-2 12-6 10-2	7 10 6-4 9-6	4-0 7	0 12-3
7-4 2 4	3 10-6 9-2	10 8-3 4	4 3 5
9 8 3	 1 8-8 5	 9 7-6 9-3	8-6 4 7-3

(b) Students sit in a circle. Everyone claps hands on legs then claps hands together... repeat then snap fingers. Caller gives a multiplication (or other operation) fact like 7 x 6 = ___ and points to someone to answer. If responder is correct, that person becomes caller otherwise person is out of the game. Last person left is the winner.

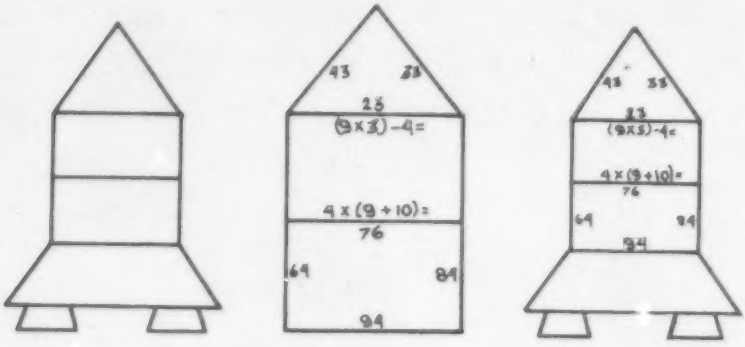
79

(c) Make heart puzzles with multiplication or division facts as shown. Cut and laminate. Students can compete on assembling puzzles then writing down or saying aloud the correct fact and answer.

(d) Draw some shape, like the rockets below. Divide the shape into pentagons, quadrilaterals, triangles. Along the edges of these geometric figures write two-step calculations exercises. Write the answer to each calculation exercise along the other side of the same edge. Put different numbers along other edges as distractors. Cut out all the geometric figures, laminate them and store in a plastic bag.

Students must do the correct calculation and match problem with answer edges to produce original shape.

Increase level of difficulty by using three-step calculations or by preparing exercises with fractions or decimals. Perhaps have the students prepare shapes and exercises for their classmates to solve.



★4/6-5 OBJECTIVE: Round a whole number to any given place value.

ACTIVITY: As illustrated below, prepare a chart on a spirit master and also for projection with an overhead. DAR stands for Digit At the Right. Use the chart as follows:

1. Write the number to be rounded in the lefthand column.
2. Record the place to which the given number should be rounded in the "Round To" column.
3. Using information from #2 underline digit to be rounded in number placed in lefthand column.
4. Fill in DAR column.
5. Complete chart using these situations:

   a) If DAR $<$ 5, then rounding digit stays the same and all digits to the right become zeroes.
   b) If DAR $\geq$ 5, then rounding digit is increased by one and all digits to the right become zeroes.

Give many examples and cover many possibilities.

Number	Round to	DAR	DAR <5	DAR ≥ 5	Therefore
3124	100's	2	3100		3124$\approx$3100 to nearest 100's
3884	100's	8		3900	3884$\approx$3900 to nearest 100's
5999	10's	9	6000		5999$\approx$6000 to nearest 10's

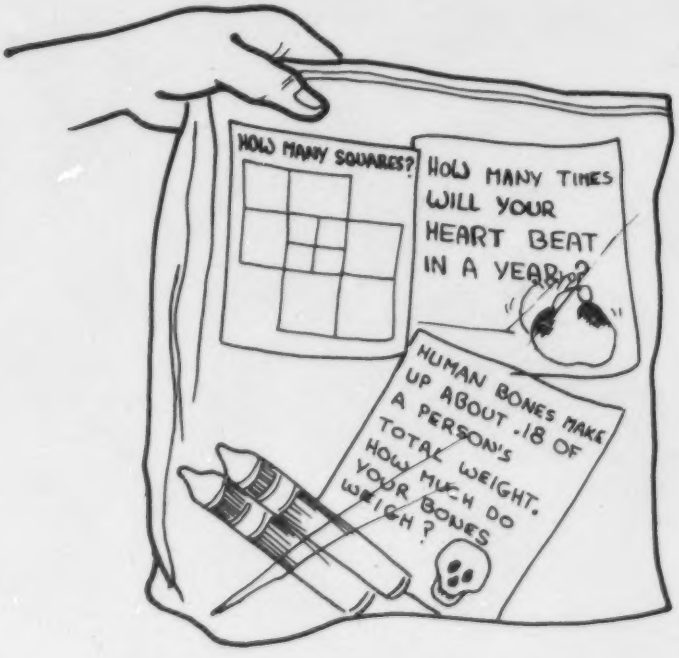
★4/6-6 OBJECTIVE: Consider relative costs of products and services.

ACTIVITY: Prepare a chart as shown below for each student. Collect newspapers for about two weeks. Have students go through the ads in newspapers--both display and classified ads--cut out or write items with price to complete their own charts. Students must total price of each column. Talk about the importance of each item and why the student wants them. Do exercise again after several months. Compare charts. Discuss how our priorities change. Assign students to calculate new column totals and percentage of change.

THINGS I WANT NOW	THINGS I WANT SOON	THINGS I WANT IN AWHILE

★ 4/6-7 OBJECTIVE: Develop a "Problem Solving Center".

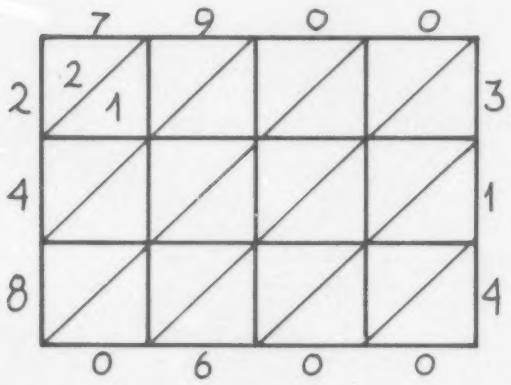
ACTIVITY: Cut out various thought problems from old textbooks and back issues of Arithmetic Teacher. Laminate them. Use three to five problems for one zip lock bag. Assign points for each problem. Redeem points for prizes or figure points into grade average.

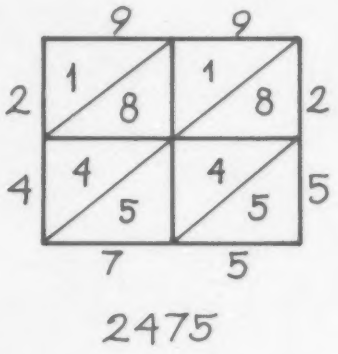

HOW MANY SQUARES?
HOW MANY TIMES WILL YOUR HEART BEAT IN A YEAR?
HUMAN BONES MAKE UP ABOUT .18 OF A PERSON'S TOTAL WEIGHT. HOW MUCH DO YOUR BONES WEIGH?

Also, assign groups of students to prepare three to five thought problems each, as a special project for the grading period. Utilize these problems for Math Fair, Parade of Problems, for parents, etc.

★4/6-8 OBJECTIVE: Multiply with a different algorithm.

ACTIVITY: As shown, make squares for multiplication exercises with equal digit numbers (e.g. 25 x 99) and rectangles for unequal ones (e.g. 790 x 31). Bisect the small squares or rectangles formed to make a lattice. Place products within bisected parts then add diagonally for final answer.



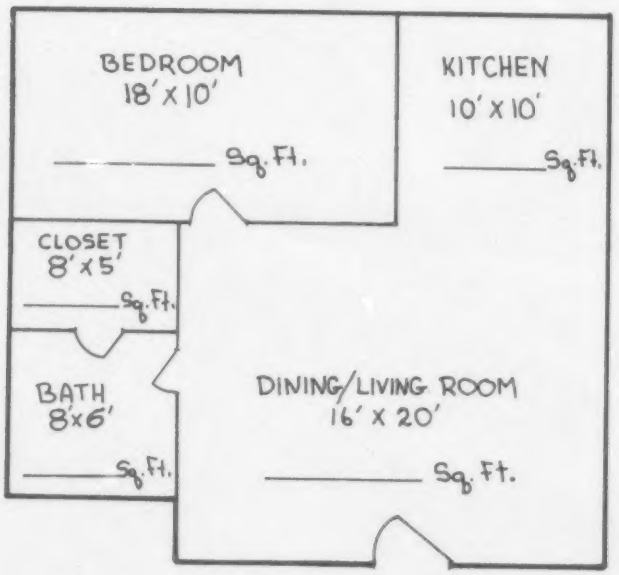


★4/6-9 OBJECTIVE: Bring mathematics "into the home".

ACTIVITIES:
Floor plans of homes can be source for a variety of mathematical problems. Example floor plans may be obtained from newspapers or perhaps from old real estate agency listings. Some students might want to design their own floor plans.

(a) Provide students with a house floor plan and commercial catalogues of various furniture. Have students cut out the pictures of the furniture they want. Students must identify to which room the furniture belongs and maintain a record of expense for each item. Student next calculates total initial cost for each item and perhaps figures final cost (if furniture is bought on installment plan).

(b) Have students chose the same or a different hypothetical house to furnish with drapes, curtains and carpeting. Provide catalogues with pictures and prices of these. (Free old catalogues may be obtained from some stores at end of one season when new catalogues are coming out.) Students select and cut out pictures of their choices and prepare a collage from them. Students next calculate cost of these furnishings including rods, brackets, hooks, rug pads, labor, etc.



★4/6-10 OBJECTIVE: Practice long division with one-digit or two-digit divisors.

ACTIVITY: Make a game board and a deck of cards. Have different colored beads, coins, etc., to use as "movers". The game board will have a trail with a beginning point and a finish point. On this trail, you should have numbered steps. These steps should be numbered from thousands up, but not in sequence. Example: 1124, 1345, 4457, 1231, etc. The deck of cards should be numbered from 0 through 9.

Up to four players may participate. The first player draws a card. The number on the card is the divisor the player must use to divide into the starting number on the board. The remainder to the division problem gives how many steps player moves. If the solution is wrong, the player must remain at step and lose turn. The player next in line, checks to see if the first player worked the problem correctly. This process continues until a player reaches the finish. The winner then gets a reward.

★4/6-11 OBJECTIVE: Provide an alternate long-division algorithm.

ACTIVITY: For students who consistently cannot make the appropriate decisions to solve long-division exercises try this "decision free" algorithm.

1. Copy the problem
2. Draw a vertical line to the right of the problem.
3. Make a guess and write that down behind the vertical line.
4. Multiply the guess by the divisor and subtract from the dividend.
5. Repeat the process until subtracting produces a number less than divisor.

52) 86310	
52000	1000
34310	
20800	400
13510	
10400	200
3110	
2600	50
510	
416	8
94	
52	1
42	
	1659

6. Quotient is the sum of the guesses.

7. Check by multiplying quotient times divisor and adding remainder.

check:
$$\begin{array}{r} 1659 \\ \times\ 2 \\ \hline 3318 \\ 8295 \\ \hline 86268 \\ +42 \\ \hline 86310 \end{array}$$

★4/6-12 OBJECTIVE: Compare a whole with its fractional parts.

ACTIVITY: Give each student a baseball sized lump of clay. Allow time for the students to make something with the clay then have them roll clay back into ball shape. Next, instruct each student to divide clay ball into equal parts (halves or thirds or fourths, etc.) and make a different shape from each fractional part.

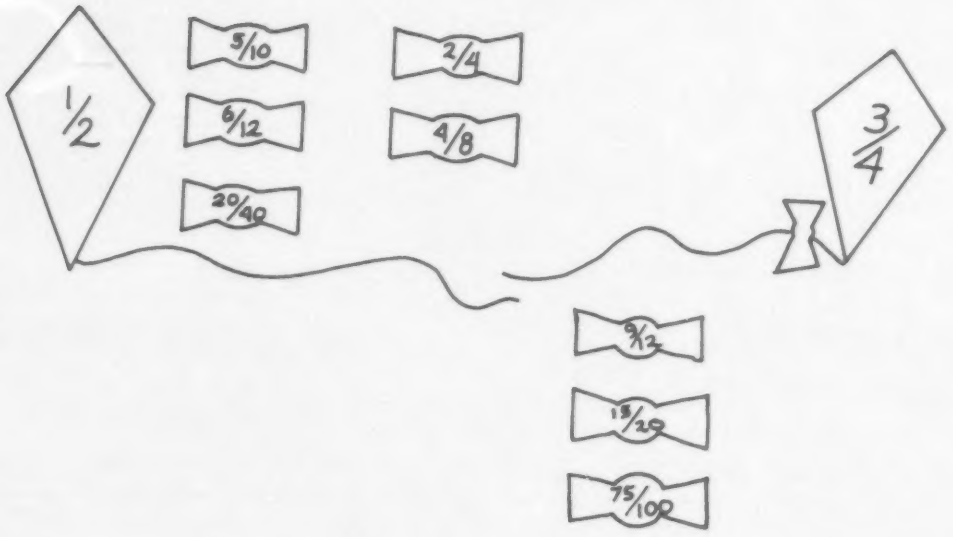
As students are working with new shapes lead discussion to notion that even though each of the parts look different each shape contains same amount of clay. Require all doubters to roll shapes back into balls and compare sizes then combine to make original ball.

Follow activity with drawings of what happened and perhaps notebook entries showing wholes equal to sums of parts.

★ 4/6-13 OBJECTIVE: Identify equivalent fractions.

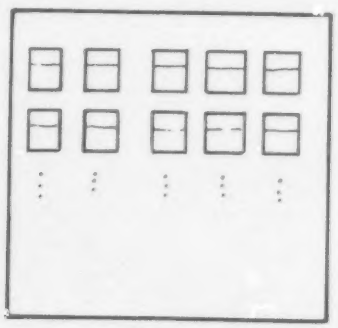
ACTIVITIES:

(a) Prepare a spirit master with kites and bows as shown. Run off copies and tape so students can cut out bows and attach to kites that name an equivalent fraction.



(b) Use twenty-five library card pockets and at least twenty-five blank cards that will fit into the pockets. Write one fraction on each card. Be sure to use many equivalent fractions. Glue pockets on paper.

Students chooses two cards; if fractions are equivalent, the student keeps the cards. Other participants follow in order. Student with the most cards is the winner.



97

★4/6-14 OBJECTIVE: Relate mathematics to social studies.

ACTIVITY: Obtain five or six maps. (Oklahoma maps are free from the Department of Transportation. Call 405-521-2579 in the State Capitol. Your school librarian may have U. S. maps.) Cover them in either contact paper or laminate them.

Give one map and a grease pencil to each group of four to five students. Give any directions you want, e.g., a two-day trip from Elk City through Lawton to Durant and return. Then have them use the legend on the map to figure mileage. Also, have each group prepare two or three problems for another group to solve; and assign groups to calculate air miles between some cities and towns.

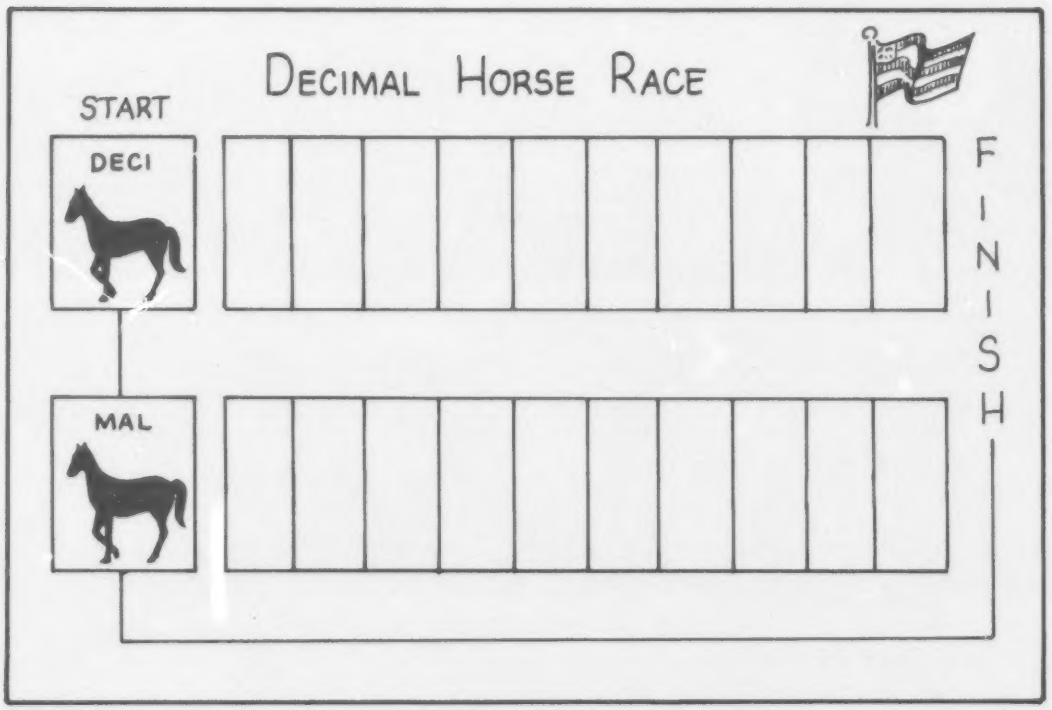
This is an excellent opportunity to teach them many map skills. The level of difficulty of problems can be expanded by having students compute costs of trip for cars with different average miles per gallon, as well as total trip costs, including meals, lodging, turnpike charges, etc.

★4/6-15 OBJECTIVE: Compute with decimals and solve problems with decimals.

ACTIVITY: Draw a game board as shown below; laminate it. Use two small plastic horses. Players push the horses down the paths as they answer questions correctly.

Make thirty playing cards for this game. Each card should have a decimal exercise like 1.56 x 3.2 on one side with the answer on the other . . . or perhaps a decimal application like: "Jim mows lawns. He earned $17.25 in the first week, $20.85 the second week and $15.15 the third. What were his total earnings and his average weekly earnings?"

Cards should be shuffled and stacked with answers down. Each player selects a horse and, in turn, one player chooses a card and works question asked. If the solution is correct, the player moves horse one step. Winner is player whose horse gets to finish first.



99

★ 4/6-16 Objective: Drill on finding the least common denominator, greatest common factor, converting to mixed numerals.

ACTIVITY: Prepare twenty-four tagboard flash cards. On each card, write two or three un-like fractions. Laminate cards. Have students number on their paper from 1 to 24, then write least common denominator of each flashcard shown. Shorten time-span for calculating each L. C. D.

$\frac{2}{3}$	$\frac{3}{5}$	$\frac{1}{2}$

$\frac{3}{4}$	$\frac{5}{6}$	$\frac{1}{8}$

By using flashcards as shown below, drills on several different competencies can be conducted.

6 & 8

1. List the factors.
2. List the common factors.
3. Find G. C. F.
4. List first three common multiples.

$\frac{4}{8}$

1. Name the G. C. F. of their numbers.
2. Name the reciprocal.
3. Square the number.
4. Find the square root of the number.

$3\frac{1}{2} = \frac{?}{2}$

1. Change the mixed number to improper fraction.
2. Square the number, then square the answer.
3. Estimate the square root of the number.

★4/6-17 OBJECTIVE: Calculate commissions.

ACTIVITY: Using real estate manuals (contact a local realtor to save manuals for your class), let the students decide how much money they would like to make for the year 19__ - 19__. Each student then finds the houses he/she needs to sell to reach desired income, figures the commissions (3% to student, 3% to company), and records the transactions as follows:

Commission on House #1

6% of selling price = 6% of $56,000
.06 x 56,000 = _____

The broker receives 1/2 of commission = _____

Salesperson receives 1/2 of commission = _____

Salesperson's Commission	Balance to Earn
On House #1	
On House #2	
On House #3	

★4/6-18 OBJECTIVE: Estimate then measure lengths, areas, volumes, masses, temperatures.

ACTIVITY: Prepare worksheets or overhead transparencies that instruct students to complete appropriate tasks and fill in charts given in Chapter Four "Measurement Learning Activities" of Metric Measurement: A Handbook for Elementary Teachers and Administrators (Oklahoma State Department of Education, 1977).

Note: A limited number of these handbooks are still available free-of-charge from the Curriculum Section, Oklahoma State Department of Education Building, 2500 North Lincoln Boulevard, Oklahoma City, OK 73105.

91

★4/6-19 OBJECTIVE: Motivate and review.

ACTIVITIES:

(a) Modify the old "Spelling Bee" idea and apply to mathematics. Divide the class into several teams. Have a member from each team go to the blackboard and attempt to solve a given problem or exercise. Assign points on the basis of progress toward solution. Accumulate team points.

Increase involvement by the following suggestions:

i) matching students of approximately the same mathematical competence,
ii) giving extra points to a team if members at desks solve before competitors at the board,
iii) graphing team results through several competitions, and
iv) challenging the room next door or the next grade.

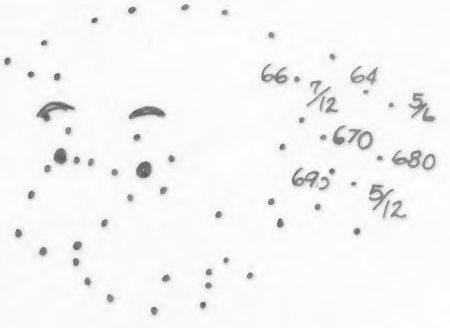
(b) Set up "connect the dots" puzzles. Each student solves exercise one then finds the dot next to that answer. The student connects this dot to the dot adjacent to the answer for exercise two. From there, the student connects a line to the answer to exercise three, etc., until a design is formed.

Put in some answers not related to the problems and thereby, increase difficulty. Consider this example:

1. 268 ÷ .4 = 670.

2. 2/3 + 3/4 = 7/12.

3. 15 + 16 + 17 + 18 = 66.



(c) Set your room to look like a "Fair". Hang crepe paper and signs. Set tables or desks with activities on them. Combine your class with several others and use parents to monitor each activity station (or, if you are short of help, provide self-scoring activities). Activities should use many manipulatives (cooking utensils, measuring devices, graphs, models, etc.) and cover full range of topics covered in mathematics.

Give each student a specified amount of play money. Each student buys an activity to do at the "Fair". Student does the activity and then buys another one.

Have students maintain a record of money spent and activities completed.

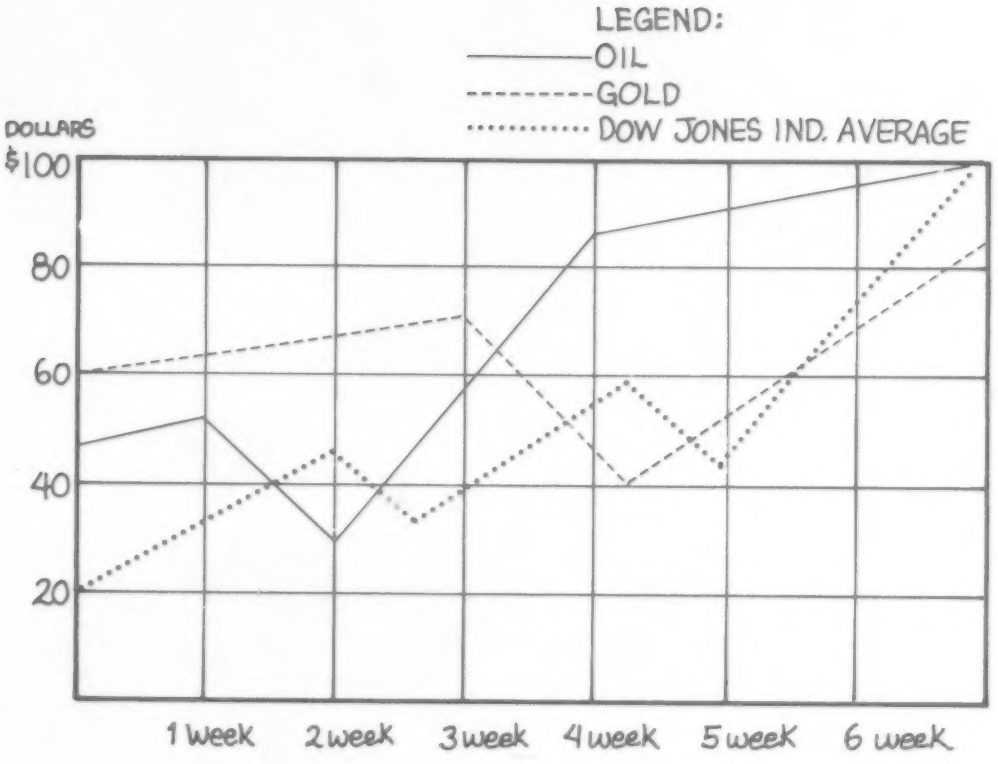
★4/6-20 OBJECTIVE: Interpret information from graphs and use graphs to make predictions.

ACTIVITIES:

(a) Have students keep an individual weather graph for one week (or more). On Friday have them graph their predictions for the weekend. On Monday, have everyone check their prediction.

(b) Require students to pick two graphs from magazines, newspapers, old textbooks, etc. with which they would like to work. The students will cut out and paste each graph at the top of a separate sheet of paper. Have each student write a paragraph (or more) explaining the information depicted by the graph and require each student to make three predictions from the graph.

(c) Choose at least three selections of merchandise, stocks, or precious metals, and graph the price from the newspaper reports or daily quotations on the radio/TV for five weeks or more. Use a different style of line (solid, dotted, dashed) for each article graphed. Have students illustrate their predictions of prices for the next week by using colored lines.



★4/6-21 OBJECTIVE: Prepare figure, bar, and broken-line graphs.

ACTIVITIES:

(a) As bulletin board projects or wall poster projects have small groups of students construct figure or bar graphs illustrating statistics like:

i) the number of students throughout the school with red hair, blonde hair, etc.
ii) the number of fifth graders who earned all A's, A's and B's, all B's, etc.
iii) the average height of all 4th graders, all 5th grader's etc.

(b) Have each student make and keep a broken-line graph for test scores in several subjects over a nine-week period. Each subject could be shown with a different color.

★ 4/6-22 OBJECTIVE: Solve assorted money problems.

ACTIVITIES:

(a) Have students cut out and make a collage of many different ads geared toward the "bargain approach". Have students figure the actual savings. This could lead to a very good discussion about how one might buy things and later find out the savings were not as great as expected.

(b) Have students bring coupons their families no longer save. After an adequate number of coupons have been collected, direct students to find the same items in the newspaper or magazine. Calculate the by-item and the total savings in using coupons.

(c) Have students search through the newspaper and find 10-15 items at a sale price. Students then find several stores that stock the same item and determine which store has the best price. Circle the best price, including how much savings would be made between the highest and lowest price. Use a chart like this:

Item	Store 1	Store 2	Store 3	Savings

(d) Using magazines, catalogues, and newspapers plus large sheets of bulletin board paper, have the students prepare collages for a picnic. Include all items needed. Keep a record of the expense for each item and then figure the total cost. If the cost, in reality, is too exorbitant, have the students figure out where the costs can be cut . . . follow up by having the picnic.

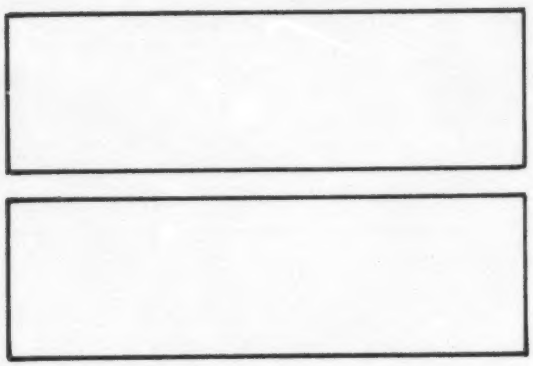
★ 4/6-23 OBJECTIVE: Practice estimation.

ACTIVITY: Have a student call or write a nearby newspaper and find out the cost of "display ads". Then have the students pick out several ads from the newspaper, measure them and figure the cost; calculate cost for ten to twenty examples. Test the students by choosing different ads and having the students estimate the cost.

★4/6-24 OBJECTIVE: Extend student acquaintance with spatial relations in two dimensions.

ACTIVITY: Purchase or construct the seven shapes used in the ancient Chinese tangram puzzle. Illustrate a few of the thousands of figures that can be made by arranging the puzzle pieces different ways. Have students prepare a tangram bulletin board or conduct a tangram puzzle contest in which students duplicate some of the ancient figures or make a few of their own. Keep the shapes available for year long use in your activities center.

97



Grades 7-8

Grades 7 — 8

SPECIAL COMMENTS

How can teachers facilitate the learning of mathematics by seventh and eighth graders while these same students are undergoing one of the major transitional stages of life? This section is designed to increase educators' effectiveness in designing successful classroom experiences built around the developmental and behavioral characteristics of this age student. The practical ideas found on the following pages reflect awareness of the following three factors.

First, the range of mathematical competencies of seventh and eighth graders tends to be wider than in any previous grade. The causes for this spread include student attendance patterns in earlier grades, differences in certain intellectual abilities and learning styles, being exposed to varying instructional practices as a result of attending several schools, and long term effects of differences in home environments. To counteract these forces, the effective teacher focuses on improving competencies by using techniques like extra short-term drill sessions, by a personal home visit, or by a "Ladder of Learning"* style review of some basic concepts or skills.

Second, many seventh and eighth graders have matured intellectually so that they are capable of considerably more abstract thinking than in previous years. In Piagetian terms, some seventh and eighth graders have moved from the concrete operational to the propositional stage. The effective teacher provides frequent and interesting challenges for these students by supplementary work with unusual topics like topology or truth tables, by assigning at least one challenge problem each day, or by offering Algebra I in the eighth grade.

Third, most seventh and eighth graders are changing physically and psycho-socially. Although there are wide variations in the rate of change as well as the age at which these changes begin, the evidence of physical changes is indisputable. Their self-concepts change. They demand fairness and justice for themselves and others. They seek positive role models. Their emotions may appear to fluctuate like a sine curve. They see the peer group as their one bastion of security and comfort amidst all the changes within and around them. The effective teacher listens carefully, sets realistic goals, and works diligently with the students as they attain them, develops a pleasant work-oriented classroom atmosphere, and provides teaching/learning activities that stress group interaction and public awards.

*See OBJECTIVE: 1-18

In addition to using the ideas on the following pages, it may behoove the teacher of seventh or eighth grade mathematics to review the Special Comments that precede the objectives and activities for grades four through six. In particular, seventh and eighth grade mathematics teachers may find the suggestions regarding notebooks to be of special value.

Objectives

		Page
7/8-1	Add a "ragged column" of whole numbers	114
7/8-2	Work with the Moeibus strip	114
7/8-3	Determine whether any given whole number is prime	115
7/8-4	Increase speed in certain multiplication and division problems	115
7/8-5	Estimate and measure volumes	116
7/8-6	Apply mathematical skills to a wide variety of daily situations	116
7/8-7	Demonstrate understanding of exponents	119
7/8-8	Illustrate some common geometric terms	119
7/8-9	Compare fractions	120
7/8-10	Multiply whole numbers times fractions and mixed num - bers	120
7/8-11	Illustrate the meaning of division with a fractional divisor	121
7/8-12	Expand knowledge of the properties of regular prisms and pyramids	122
7/8-13	Explain "Why the Decimal Rules Work"	122
7/8-14	Find the generating fraction for a repeating decimal	123
7/8-15	Illustrate percentages	123
7/8-16	Illustrate the sign rule for "A Positive Times A Negative"	124
7/8-17	Construct bar graphs	124
7/8-18	Complete a mathematics project	125
7/8-19	Practice basic computational skills	128
7/8-20	Review any topic	131

★ 7/8-1 OBJECTIVE: Add a "ragged column" of whole numbers.

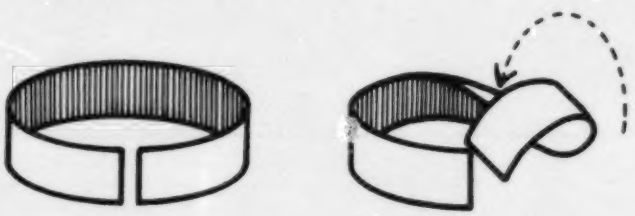
ACTIVITY: Present this method of partial sums to students who still have difficulty with adding "ragged columns" of whole numbers. For example:

```
 3425
 5917
  231
   82
 ----
   15 ———————————— unit sum
  14  ———————————— tens sum
 15   ———————————— hundreds sum
 8    ———————————— thousands sum
 ----------------------------------
 9655 ———————————— final sum
```

★ 7/8-2 OBJECTIVE: Work with the Moeibus strip.

ACTIVITY: Cut strips of paper three inches wide and fourteen to twenty inches long. Prepare enough so each student will have four to five strips.

Have each student pick up the ends of one strip in opposite hands. The left hand should be kept steady and the right hand used to provide 0, 1, 2, or 3 half-twists. The student should make one of each type by taping or stapling the ends together (the strip with one half-twist will look like this). Cut each strip down the middle.



Allow students to work with partners or in small groups to complete a chart. In this chart students should note characteristics like the number of pieces after each cut, the number of sides to those pieces, the relationship between the number of half-twists to the number of sides, etc.

★ 7/8-3 OBJECTIVE: Determine whether any given whole number is prime.

ACTIVITY: Have students follow these steps:

1. Estimate the square root of the given number (or find a rather accurate approximation with a calculator).
2. Divide the original number by all primes less than the square root found in step 1.

For example, to find whether 631 is prime, student must do the following divisions (since $\sqrt{631} \approx 25+$).

631 ÷ 3	631÷13
631 ÷ 5	631÷17
631 ÷ 7	631÷19
631÷11	631÷23

★ 7/8-4 OBJECTIVE: Increase speed in certain multiplication and division problems.

ACTIVITY: Give timed tests where students must use the following short cuts.

To multiply by:

1. 5,50,500,etc., just multiply by 10,100,1000,etc. and divide by 2;
2. 25,250,2500, etc., just multiply by 100,1000,etc. and divide by 4;
3. 33 1/3, 16 2/3, 12 1/2, 8 1/3, 6 1/4 multiply by 100 and divide by 3,6,8,12,16, respectively.

To divide by:

1. 3 1/3, just multiply by 3 and divide by 10;
2. 33 1/3, just multiply by 3 and divide by 100;
3. 16 2/3, just multiply by 6 and djvide by 100;
4. 25, just multiply by 4 and divide by 100;
5. 50, just multiply by 2 and divide by 100.

★ 7/8-5 OBJECTIVE: Estimate and measure volumes.

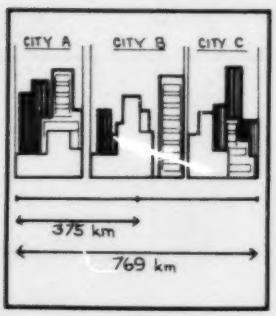
ACTIVITY: Have students bring various containers (cans, bottles, boxes). Remove or cover all labels that state the volume of each container. Let students estimate how much liquid or solid each container will hold. Record these estimates. Then have students calculate the actual volume by using appropriate mathematical formulas and by using standard measures of sand or water to fill each container. Record volumes obtained by each of these methods. Compare with recorded estimates. Have students calculate percentage of difference.

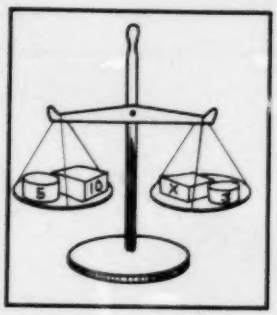
★ 7/8-6 OBJECTIVE: Apply mathematical skills to a wide variety of daily situations.

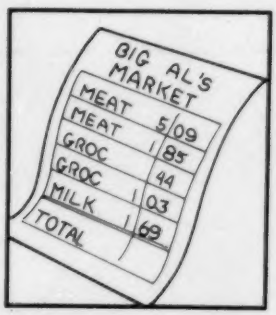
ACTIVITIES:

(a) Obtain out-of-date pattern books from fabric shops or department stores. Let each student look through the books and select two or three outfits. Using the pattern books, magazines, newspapers or other commercial catalogues, each student should calculate the cost of each outfit. Then, each student should compare these costs to the prices of similar ready-to-wear outfits.

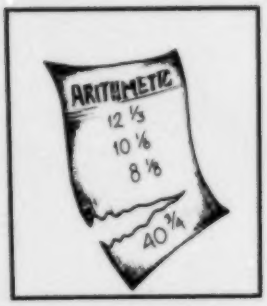
(b) Duplicate worksheets similar to the ones below. Have the students formulate and solve problems from the information given in the pictures.

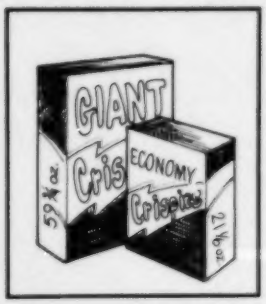






194





(c) Direct students to save the advertising inserts from magazines and newspapers. Assign each student to convert percentage discounts to fractional discounts and vice versa; then convert either to the equivalent decimal. Using the decimal form, each student should calculate the new selling price and the amount of money saved.

Using an advertisement of 25% off on $56 shoes as an example, student would show the following work:

25% = 1/4 = .25

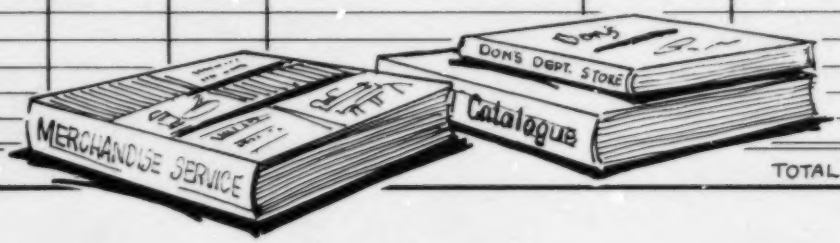
$56.00
.25
28000
11200
$14.000 savings

$56.00 list price
14.00 savings
$42.00 sale price

(d) Have students calculate the cost of a night out for their parents. Students must check their figures against local advertisements. Conclude activity by having students donate babysitting time to reduce costs for their parents.

(e) Ask students to bring old merchandise catalogues. Obtain merchandise order forms from commercial sources or prepare some. Allow students to select items they wish to purchase, then fill in merchandise order forms. Be sure that the students show both unit cost and extension and that they calculate additional charges like sales taxes, handling, postage, finance charges.

PAGE NO.	STOCK NO.	SIZE OR COLOR	DESCRIPTION OF ITEM	SHIPPING CHARGES	SALES TAX	PRICE
					TOTAL	



(f) Contact several of the restaurants or fast food services in your town to obtain their paper menus. Laminate the menus. Make some order form books or buy some from an office supply company.

Students must select a snack or lunch from the menu, then fill out an order form including sales tax and tip.

This activity could provide an excellent opportunity for role playing and modeling good manners in public.

(g) Have students cut out fifteen to twenty ads that show an item's list price and discount price. Assign students to glue each ad to paper and then calculate the amount and the percentage of the discount as follows:

list price \$1.69
sale price 1.23
savings .46

$\frac{46}{1.69} = 1.69\overline{).46.000} \approx .27 = 27\%$

check: 1.69
x.27
1183
338
.4563 = .46

106

★ 7/8-7 OBJECTIVE: Demonstrate understanding of exponents.

ACTIVITY: Have students complete several exercises of the following types:

1. Show whether $3^4 \stackrel{?}{=} 3 \times 4$,

   $5^3 \stackrel{?}{=} 5 \times 3$,

   $6^4 \stackrel{?}{=} 6 \times 4$.

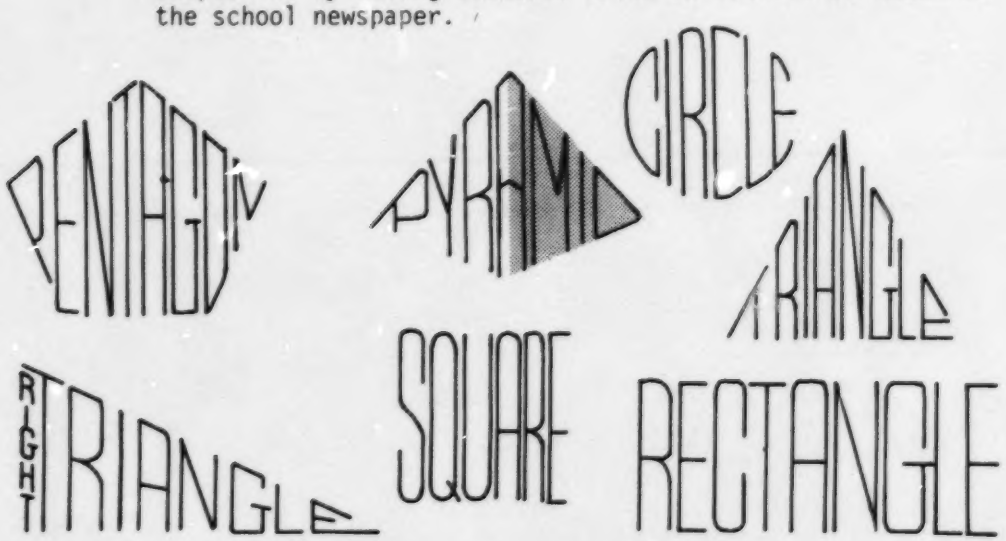
2. Show which is larger 2^6 or 6^2,

   7^8 or 8^7,

   $(\frac{1}{2})^3$ or $(\frac{1}{2})^2$.

★ 7/8-8 OBJECTIVE: Illustrate some common geometric terms.

ACTIVITY: Prepare an overhead transparency with some of these "word shapes". Brainstorm with the students to develop "word shapes" for many more mathematical terms, like "square root", "cone", "parabola", "divide". Culminate by having students prepare a bulletin board of these "word shapes" or by having students write an article on them for the school newspaper.



★ 7/8-9 OBJECTIVE: Compare fractions.

ACTIVITY: Present this method for comparing fractions. Assign numerous exercises using this method:

1. Cross multiply the numerator of the first fraction with the denominator of the second.

2. Compare this product with the product of the denominator of the first fraction times the numerator of the second.

For example, which is bigger $\frac{4}{5}$ or $\frac{5}{7}$? Using the cross-multiplication method outlined above -

$4 \times 7 = 28$ $\qquad$ $5 \times 5 = 25$

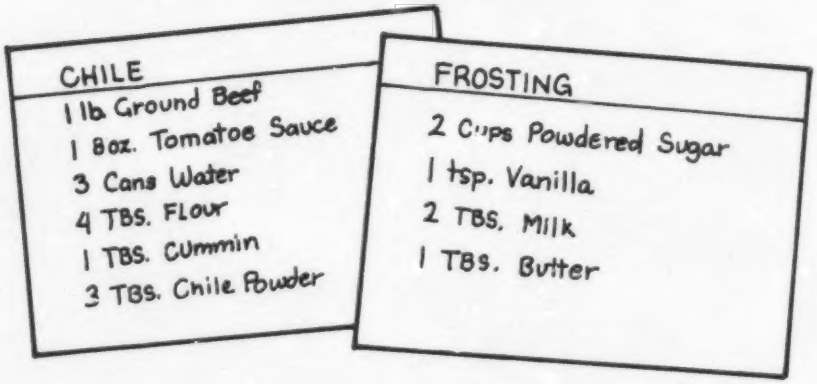
so, $\frac{4}{5} > \frac{5}{7}$.

How about $\frac{6}{13}$ and $\frac{7}{12}$?

★ 7/8-10 OBJECTIVE: Multiply whole numbers times fractions and mixed numbers.

ACTIVITY: Have students select several recipes from old cookbooks or magazines. Cut the recipes out and glue on paper. Assign each student to double, triple and quadruple the quantities of ingredients to be used and show these calculations on the paper next to the recipe.

If someone finds a recipe that does not require heating, assign all students to calculate how much of each ingredient would be needed to feed the class. Have students volunteer to bring the needed items and make the dish during break time the next day.

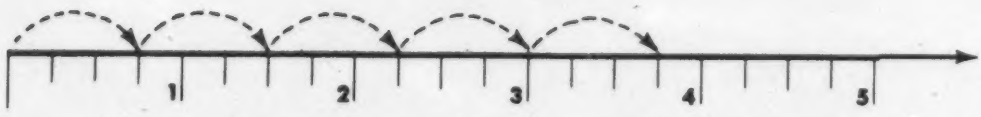


★ 7/8-11 OBJECTIVE: Illustrate the meaning of division with a fractional divisor.

ACTIVITY: Require students to be able to explain to their classmates, one of the following illustrations of division by a fraction.

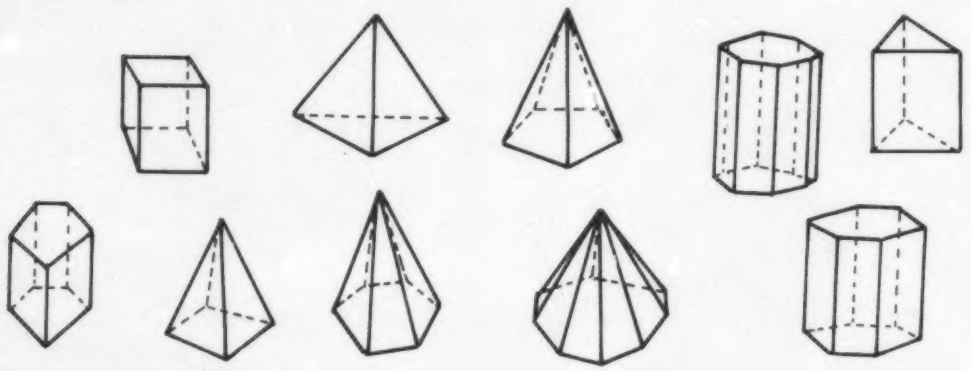
1. A problem like 2/3 ÷ 1/6 can be shown by diagrams. In terms of "How many 1/6's can 2/3's be divided into?" The answer is four by counting.

2. The number line can be used to show 3 3/4 ÷ 3/4 = 15/4 ÷ 3/4 = 15/4 x 4/3 = 5. On the number line, the question becomes, in effect, how many 3/4 of a unit steps are needed to go from 0 to 3 3/4. The answer as shown below is 5.



★ 7/8-12 OBJECTIVE: Expand knowledge of the properties of regular prisms and pyramids.

ACTIVITY: Design a unit on prisms and pyramids. Include topics like identifying examples in architecture and nature, verifying Euler's Formula, deriving formulas for surfaces, areas, and volumes, studying symmetrics, examining results of intersections with lines or planes, constructing models. Assign students to record important processes followed and conclusions reached. Require small groups of students to design similar units for other geometric solids.



★ 7/8-13 OBJECTIVE: Explain "Why the Decimal Rules Work".

ACTIVITY: Before presenting each of the "rules for decimal points", require the students to solve the appropriate computation by converting the decimals to fractions. The answer from the computation with the equivalent fractions must then be converted back to a decimal form. For Example:

$$3.2 + 5.67 + 4.104 = 3\frac{200}{1000} + 5\frac{670}{1000} + 4\frac{104}{1000}$$

$$= 12\frac{974}{1000} = 12.974.$$

Note: A half dozen exercises like this for each rule may help students appreciate the benefits of memorizing the rules.

★7/8-14 OBJECTIVE: Find the generating fraction for a repeating decimal.

ACTIVITY: Outline these steps on the blackboard or a spirit master. Give plenty of extra exercises for student practice.

1. Determine the length of the repeating period.
2. Set up an equation for the repeating decimal and another for the decimal multiplied by a power of ten equal to the length of the repeating period.
3. Subtract the first equation from the second and solve resulting equation.

Use these examples in original explanation/discussion.

Let $x = .8\overline{88}...$

$10x = 8.\overline{88}...$

$-x = -.\overline{88}...$

$9x = 8$

$x = \frac{8}{9}$

Let $x = .45\overline{45}...$

$100x = 45.\overline{45}...$

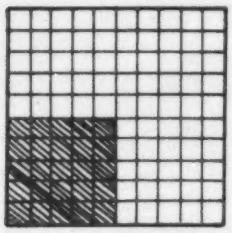
$-x = -.\overline{45}...$

$99x = 45$

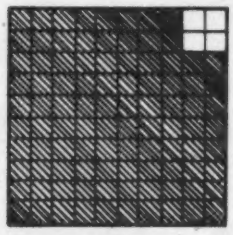
$x = \frac{45}{99}$ or $\frac{5}{11}$

★7/8-15 OBJECTIVE: Illustrate percentages.

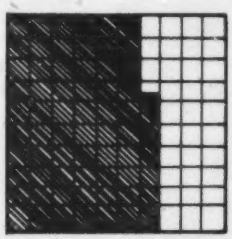
ACTIVITY: Provide graph paper with one-half centimeter grids. Assign students to outline at least eight 10-by-10 blocks as shown below. Then, since each block contains 100 units, students can shade in enough units to illustrate 25%, 96%, 33 1/3%, etc.



25%



96%



33⅓%

★ 7/8-16 OBJECTIVE: Illustrate the sign rule for "A Positive Times a Negative".

ACTIVITY: Hand out spirit master sheet that shows these patterns before presenting a deductive proof.

3 x 3 = 9	2 x 3 = 6
3 x 2 = 6	2 x 2 = 4
3 x 1 = 3	2 x 1 = 2
3 x 0 = 0	2 x 0 = 0
3 x -1 = -3	2 x -1 = -2
3 x -2 = -6	2 x -2 = -4
⋮ ⋮ ⋮	⋮ ⋮ ⋮

★ 7/8-17 OBJECTIVE: Construct bar graphs.

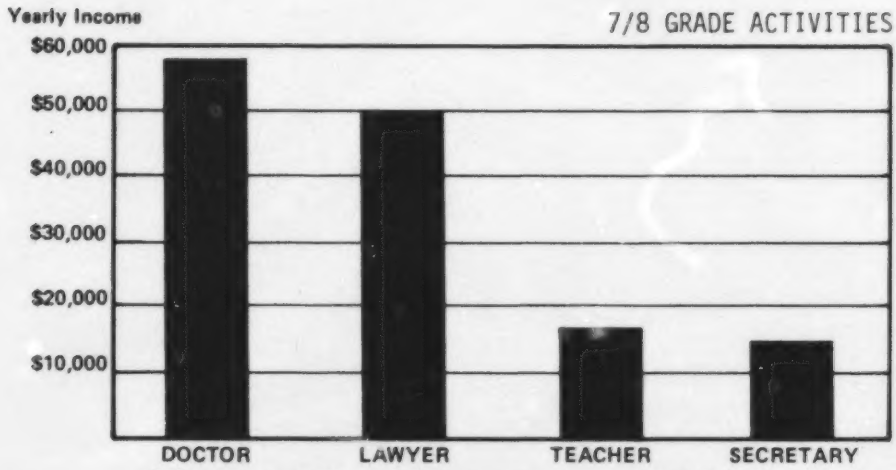
ACTIVITIES:

(a) Obtain several old telephone directories (when new directories are issued, many offices will donate their out-of-date books).

1. Have students calculate the percentage of pages for family names starting with "R", "S", "T", etc., compared to the total number of pages of names. Have each student make a bar graph of these percentages.

2. Have students use the Yellow Pages and show (as percentages) the ratio of pages of doctors to total pages, pages of lawyers to total pages, pages of plumbers to total pages, etc. Students also may compare pages for bookstores to pages for clothing stores, pages for restaurants to pages for fast-food stores, pages for churches to pages for theaters, etc. Then each student should design a bar graph that shows at least three similar comparisons.

(b) Have students find average monthly salaries for several careers and prepare bar graphs illustrating this data. Expand on this idea by investigating further to find average entry-level earnings and average upper-level earnings. Have students work in small groups to prepare more sophisticated charts or graphs for this additional information.



(c) Meet with teachers in other disciplines and ascertain what information students could lay out in chart form to improve learning in those disciplines.

(d) Have students graph income from several student clubs or activities.

★ 7/8-18 OBJECTIVE: Complete mathematics project.

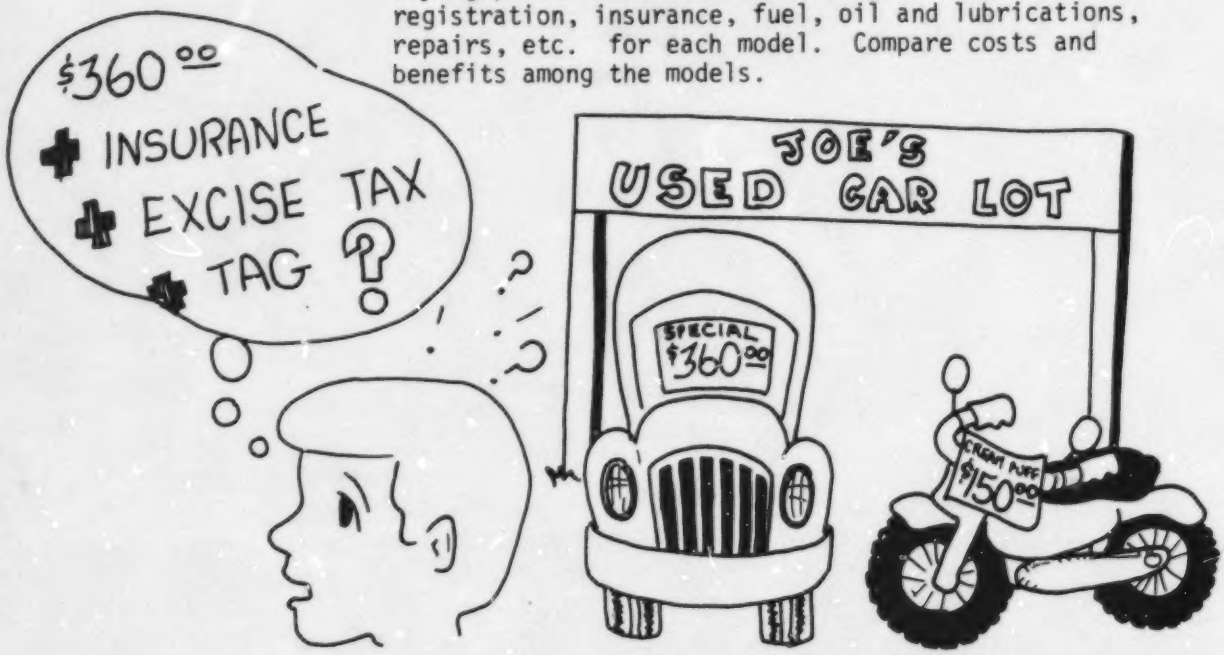
ACTIVITY: Assign pairs or small groups of students to complete short term or long term mathematics projects. Possible projects include the following:

1. Make a booklet of instruments used in mathematics and demonstrate their use.

2. Make a time-line showing famous mathematicians, the years they lived and their major accomplishments; or one showing the development of computing machines beginning with early methods of counting (stones and knots on ropes) to devices like the abacus to modern hand-held calculators and computers.

3. Record each use of numbers for an entire day. Repeat on a different day of the week. Then indicate how our lives would be affected if we had no numbers.

4. Compute the lifetime cost of a used car or motorcycle. Select several favorite models. Calculate buying price and installment charges if appropriate, registration, insurance, fuel, oil and lubrications, repairs, etc. for each model. Compare costs and benefits among the models.



5. Chart the types of programming on several television channels. List the various types of programs shown such as news broadcasts, variety shows, movies, "soap operas", commercials. Calculate the number and length of time for the various categories over a two-week period. Determine percentage of total time for each program class. Graph the results for several different channels.

6. Show the relationship of math and art (perspectives, enlargements), or the relationship of math and music (symbol-system, calculating harmonies).

7. Prepare several reports on methods of saving and investing. Obtain information from parents, financial institutions, libraries, business teachers, etc.

8. Report on jobs or careers which depend strongly upon numbers and mathematics and jobs or careers that require little or no math. Compare salaries of these jobs or careers.

9. Plan two month-long vacations. Contact a travel agency and obtain brochures and maps. Select desired destination and trace on the maps. Calculate the cost of the trips, including the cost of admission fees, food, lodging, money spent shopping. Show comparisons of airfare vs. using a bus, car, or van and taxis vs. rental cars.

10. Graph the measures of certain economic indicators like the Dow Jones average, the price of gold, the consumer price index for a nine to eighteen week period. Collect major news articles for the same period. Compare these news items with the graph of major indicators to ascertain whether there are any relationships between the economy and the local, national, or international situation. Make some predictions for the next eighteeen week period.

11. Plan and plant (if possible) a flower or vegetable garden. Use seed and gardening catalogues or advertisements. Study "How To" book in the library. Calculate the size of the plot. Compute costs of materials and labor. Record yields. Compare unit cost with unit costs of flowers or vegetables available in markets. Recommend a course of action for other students.

★ 7/8-19 OBJECTIVE: Practice basic computational skills.

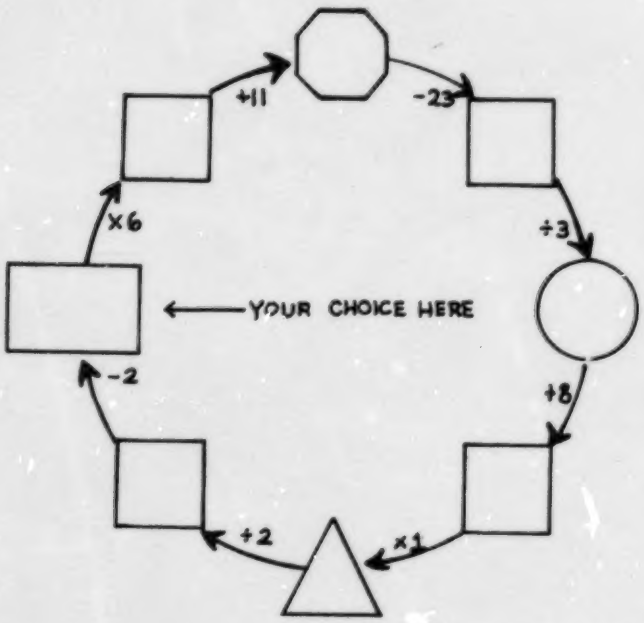
ACTIVITIES:

(a) Assign a monetary value to each letter of the alphabet (e.g. A = $1, B = $2, C = $3, . . ., Z = $26). Then have students calculate:

1. Who has the most valuable name?
2. What state has the most valuable name?
3. What is the most valuable food?
4. What is the most valuable digit?

Note: This activity could be used to practice multiplication of whole numbers (using short words). It could also be used for practice with decimals and fractions.

(b) Make up "circle paths" as shown. Start by having students follow paths with prescribed figures and operations. Later have students design their own "circle paths" to finish with the same number chosen to start the path.



(c) Pass out worksheets on arithmetic problems answered incorrectly. Assign students to find and correct the errors. For example:

$$\begin{array}{r} 17 \text{ r6} \\ 13\overline{)217} \\ 13 \\ \hline 97 \\ 91 \\ \hline 6 \end{array} \qquad \text{should be} \qquad \begin{array}{r} 16 \text{ r9} \\ 13\overline{)217} \\ 13 \\ \hline 87 \\ 78 \\ \hline 9 \end{array}$$

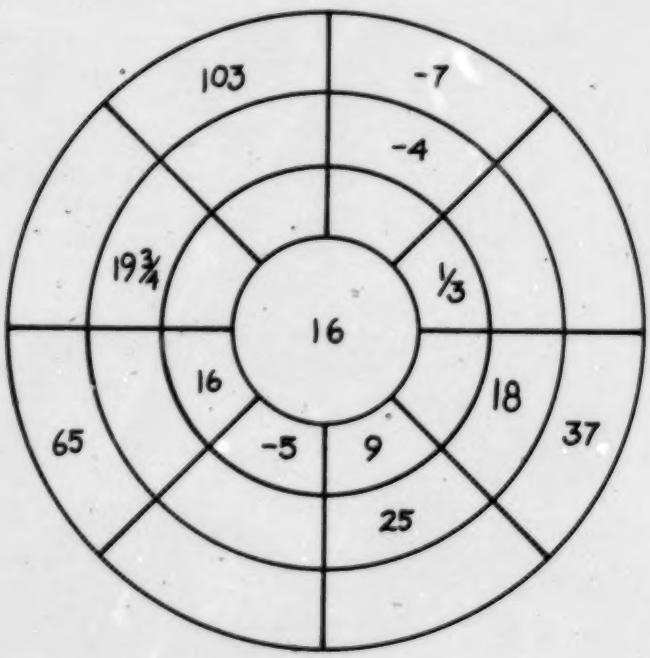
(d) Orally assign the top two or three lines of these multiplication oddities then ask the students to extend the pattern. Ask students to consult with the librarian for articles and books on other mathematical oddities.

$$\begin{array}{rr} 11 \times 11 = 121 & 1 \times 9 + 2 = 11 \\ 111 \times 111 = 12321 & 12 \times 9 + 3 = 111 \\ 1111 \times 1111 = 1234321 & 123 \times 9 + 4 = 1111 \end{array}$$

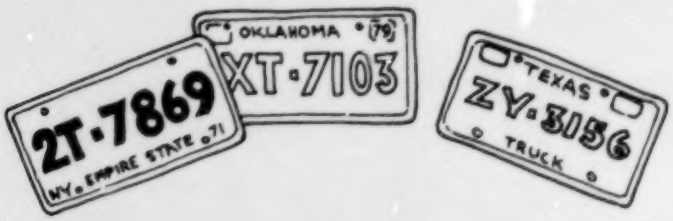
(e) Using all the digits of a telephone number and the basic operations (+, -, x, ÷), assign each student to generate (1) five numbers less than one, (2) five numbers greater than twenty, but less than fifty-five, (3) five numbers greater than 100. For example, using 521-3361 a number less than one is -5,213,361 and another is 5÷213,361. Using the same digits, (5x2) + 1 + (3x3) + (6 x 1) = 26.

This activity can be extended into generating very large numbers or very small positive numbers if some digits can be used as exponents. The level of difficulty can be increased by limiting the number of digits to be used, and by requiring that the digits be used in a specific order only, e.g., as the digits appear in the telephone number.

(f) Use sectioned concentric circles as shown below to provide a different style of computational drill. Have the students develop one pattern which if followed, will allow all blanks to be filled so as to make true statements.



(g) Collect out-of-date license plates. Have the students bring some, too. Do any of the following:



1. Have groups of students make up a code system for each number on a license plate, e.g., 4 = A, 5 = M, 8 = Z; and then write silly sentences wherein the first letter in each word is a coded number. Groups should exchange sentences and attempt to break codes.

2. Have each student calculate how many other license plates could be made using only the digits and letters from a given plate.

3. Have groups of students use the digits from the plates to prepare challenge exercises like those for the telephone digits in (e) above.

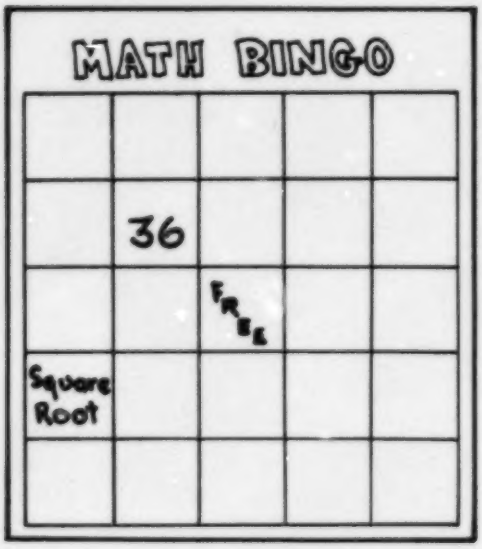
★7/8-20 OBJECTIVE: Review any topic.

ACTIVITY: Have students prepare several questions requiring short answers. Tell them to choose questions covering mathematics topics, e.g., $-6 \times -6 = ?$; "$\sqrt{\ }$" is the symbol for ?. Prepare some extra questions yourself. Make up blank bingo cards.

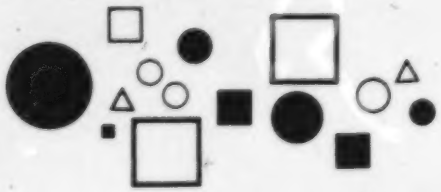
Put all the questions in a box or sack and draw them out as in a regular bingo game. Ask the question and have each student write an answer in any block on a card. Caution each student against writing the answers in the same block as another student since this may lead to every student winning at the same time.

When all twenty-four questions have been asked, put them all back into the box or sack and begin playing the game again. Draw out a card and ask the question. At this

time, each student answers the question individually. The game continues until a winner is determined as in a regular Bingo game.



Resources



Resources

BOOKS

Ahl, David H. Basic Computer Games. Creative Publications, 1978.

Ahl, David H. More Basic Computer Games. Creative Publications, 1979.

Anderson, Carol & Haller, Jackie. Brain Stretchers. (Books 1 & 2), Midwest Publications, 1975.

Anderson, Carolyn. Whole Numbers. J. Weston Walch, 1976.

Balka, Don. Polyhedra Dice Games Grades K to 6. Creative Publications, 1978.

Baratta-Lorton, Mary. Mathematics Their Way. Addison-Wesley, 1976.

Baratta-Lorton, Robert. Mathematics...A Way of Thinking. Addison-Wesley, 1977.

Barns, Robert. Tangle Table. Creative Publications, 1973.

Barns, Robert. The Answer is One. Books 1, 2, and 3, Creative Publications, 1977.

Becker, Jan, et al. Enhance Chance and Dice. Activity Resources Co., 1973.

Berry, Trish. Kaleidoscope of Skills. The Math Group, 1980.
Signed Numbers - Fractions & Decimals
Signed Numbers - Integers

Bezuszka, Stanley. Motivated Math Project Activity Booklets. Boston College, 1976.
Incredible Pascal Triangle, 1976
Fraction Action I, 1976
Mathematical Doodling, 1976
Wonder Square, 1976
Fraction Action II, 1976
Finite Differences, 1976
Super Sum, 1976
Applications of Geometric Series, 1976
Perfect Numbers, 1980

Bezuszka, Stanley. Contemporary Motivated Mathematics. (Books 1, 2, 3), Boston College, 1972.

Bezuszka, Stanley. Wonder-Full World of Numbers. Boston College, 1971.

Billings, Karen, et al. Art 'n' Math. Cuisenaire, Co., 1975.

Bitter, Gary & Mikesell, Gerald. Teaching With the Hand-Held Calculator. Allyn & Bacon, 1980.

Brandes, Louis. Math Can Be Fun. J. Weston Walch, 1956.

Brandes, Louis. The Math Wizard. J. Weston Walch, 1975.

Brandes, Louis. Excursions in Math. J. Weston Walch, 1979.

Brandes, Louis. Adventures in Math. J. Weston Walch, 1978.

Brandes, Louis. Logic Fun. J. Weston Walch, 1975.

Brownlee, Juanita. Tangram Geometry. Activity Resources Co., 1975.

Bruni, James. Experiencing Geometry. Creative Publications, 1977.

Bureloff, Morris. Number Triangles. Cuisenaire Co., 1976.

Bureloff, Morris. Contemporary Math Shade Ins. Prentice-Hall, 1974.

Burns, Marilyn. The Book of Think. Creative Publications, 1976.

Burns, Marilyn. The I Hate Mathematics! Book. Creative Publications, 1975.

Burns, Marilyn. The Good Time Math Event Book. Creative Publications, 1977.

Carl, Iris. Computing with the Tangram. Prentice-Hall, 1977.

Cornett, C. Reading Math. J. Weston Walch, 1979.

Davidson, Jessica. 2, 4, 6, 8, Let's Start to Calculate. Cuisenaire Co., 1978.

Dilley, Clyde & Rucker, Walter. Math Card Games. Creative Publications.

Dritsas, Linda. Actions with Fractions. J. Weston Walch, 1975.

Dritsas, Linda. Decimals and Percents. J. Weston Walch, 1976.

Edwards, Judy & Ron, et al. Fortified Fractions. The Math Group, 1977.

123

Fair, Jan. Electric Drill. Whole Numbers. Creative Publications, 1980.
" Fractions, 1980
" Decimals, 1980
" Per Cent, 1980

Fair, Jan. Handy Math. Focus on Purchasing. Creative Publications, 1980.
" Focus on Travel, 1980
" Focus on Sports, 1980
" Focus on Earning Money, 1980
" Focus on Managing Money, 1980
" Routes - Focus on Map Skills, 1980

Farrell, Margaret. Geoboard Geometry. Creative Publications, 1971.

Foster, Thomas. Tangram Patterns. Creative Publications, 1977.

Golick, Margie. Deal Me In! Creative Publications, 1973.

Graflund, Robert. 80 Activities For Making Basic Math Easy. J. Weston Walch, 1976.

Greenes, Carole, et al. Successful Problem Solving Techniques. Creative Publications. 1977.

Harnadek, Anita. Classroom Quickies, (Books 1, 2, & 3). Midwest Publications, 1978.

Harnadek, Anita. Mind Benders. (Deductive Thinking Skills, Levels A, B, & C). Midwest Publications, 1978.

Harnadek, Anita. Word Problems. Midwest Publications, 1980.
Introductory Problems, 1980
Whole Numbers, 1980
Fractions, 1980
Decimals, 1980
Per Cents (Books 1 & 2), 1980
General Math - Mixed Concepts (Books 1, 2, & 3), 1980

Haugaard & Horlock. Fun and Games with Mathematics. Prentice-Hall, 1974.

Haugaard & Horlock. Fun with Geometric Activities. Prentice-Hall, 1974.

Hestwood, Diane, et al. Crossnumber Puzzles Books I and II. Creative Publications, 1972.

Immerzeel, George & Ockenga, Earl. Calculator Activities for the Classroom, Books I and II. Creative Publications, 1977.

Jacobs, Russell. Problem Solving with the Calculator. Jacobs Publishing Co., 1977.

James, Susan & Pedrazzini, Louise. S. L. A. M. Division. Prentice-Hall, 1975.

James, Susan & Pedrazzini, Louise. S. L. A. M. Multiplication. Prentice-Hall, 1976.

Jenkins, Lee, et al. It's a Tangram World. Activity Resources Co., 1968.

Johnson, Connie. Dinosaurs, Skeletons, and Word Problems. Activity Resources Co., 1978.

Judd, Wallace. Patterns to Play on a Hundred Chart. Creative Publications, 1975.

Kennedy, Joe & Thomas, Diane. A Tangle of Mathematical Yarns. (Books I and II). Cuisenaire Co., 1979, 1980.

Kremer, Ronald. Good Times Again with Math. Prentice-Hall, 1975.

Kremer, Ronald. Good Times with Math. Prentice-Hall, 1975.

Krulick, Stephen (Editor). Problem Solving in School Mathematics. 1980 Yearbook. NCTM, 1980.

Krulick, Stephen & Rudnick, Jesse A. Problem Solving: A Handbook for Teachers. Allyn & Bacon, 1980.

Litwiller, Bonnie & Duncan, David. Activities for the Maintenance of Computational Skills and the Discovery of Patterns. NCTM, 1980.

Lohmann, Idella, et al. Open Windows to the World Through Newspapers, the Living Textbook. The Oklahoma Publishing Co., 1979.

Lund, Chuck & Smart, Margaret. Focus on Calculator Math. Activity Resources, 1979.

Lund, Charles. Tricks of the Trade with Cards. Activity Resources, 1979.

McCutcheon, George. The Young Mathematician Series. National Textbook Co., 1968, 1975.
The Power of Balance - Equations, 1968, 1975
Point Count-A-Point - Geometry, 1968, 1975
Fourteen Eggs Make a Dozen - Number Bases, 1968, 1975
Wilmore Has Forty Marbles - Word Problems, 1968, 1975
From Chaos to Order - Permutations, 1968, 1975
Working with Leftovers - Residues, 1968, 1975
Logarithms, 1968, 1975
Probability, 1968, 1975
Determinants, 1968, 1975
Functions, 1968, 1975

125

Marcy, Steve & Janis. Mathimagination. Creative Publications, 1973.
Book A: Beginning Multiplication and Division, 1973
Book B: Operations with Whole Numbers, 1973
Book C: Number Theory, Sets, Number Bases, 1973
Book D: Fractions, 1973
Book E: Decimals and Percent, 1973
Book F: Geometry, Measurement, Cartesian Coordinates, 1973

Marcy, Steve & Janis. Pre-Algebra with Pizzazz (4 Books). Creative Publications, 1978.

Medcalf, John, et al. Computational Skills with Whole Numbers (Books A, B, & C). Activity Resources Co., 1978.

Mehl, William. Gridmatics. (Books I and II). Creative Publications, 1974.

Miller, Don. Calculator Explorations and Problems. Creative Publications, 1979.

Newton, David. Activities for Exploring Careers in Mathematics. J. Weston Walch, 1977.

Newton, David. Math in Everyday Life. J. Weston Walch, 1976.

Newton, David. Math in the Newspaper. J. Weston Walch, 1980.

Niman, John & Postman, Robert. Mathematics on the Geoboard. Cuisenaire Co., 1974.

O'Brien, Thomas. Solve It: A Basic Approach to Problem Solving. (1-5) Cuisenaire Co., 1977.

O'Brien, Thomas. Wollygoggles and Other Creatures. Cuisenaire Co., 1980.

Pattison, Sylvia & Phillips, Jo. Math Activities Bonus Book. J. Weston Walch, 1975.

Perkins & Vurnakes (editors). Centers Galore--The 1980 Interest Center Display. The Educator Center, 1980.

Rassmussen, Peter. Key to Algebra. (Books 1 - 4), Key Curriculum Project, 1975.

Rassmussen, Peter. Key to Fractions. (Books 1 - 4), Key Curriculum Project, 1980.

Rassmussen, Peter. Key to Geometry. (Books 1 - 8), Key Curriculum Project, 1980.

Reys, Robert, et al. Keystrokes: Exploring New Topics. Creative Publications, 1980.

Robinson, Alice. Succeed in Math. J. Weston Walch, 1974.

Schulte, Albert & Choate, Stuart. Whole Numbers and Decimals. Enrich, Inc., 1979.

Schumann, Kay. Dice-A-Matics. Prentice-Hall, 1976.

Sentilowitz, M. & Thelen, J. Baseball: A Game of Numbers. Addison-Wesley Co., 1977.

Seymour, Dale, et al. Aftermath Series. (4 Books), Creative Publications, 1970.

Seymour, Dale, et al. Eureka. Creative Publications, 1970.

Seymour, Dale, & Shedd. Finite Differences. Creative Publications, 1973.

Seymour, Dale & Gregory, John. I'm a Number Game. Creative Publications, 1978.

Seymour, Dale & Gregory, John. Limerick Number Puzzles. Creative Publications, 1978.

Seymour, Dale, et al. Number Sentence Games. Creative Publications, 1971.

Seymour, Dale. Sum Puzzles. Creative Publications, 1979.

Seymour, Dale. Tangramath. Creative Publications, 1971.

Sharp, Vicki, et al. Ready in a Minute Math Games. Prentice-Hall, 1975.

Sharron, Sidney (ed.). Applications in School Mathematics. 1979 Yearbook, NCTM, 1979.

Schulte, Albert, et al. Mastering Fractions. Enrich, Inc., 1979.

Schulte, Albert & Choate, Stuart. What are My Chances? Creative Publications, 1977.

Silvey, Linda. Money Matters. Creative Publications, 1973.

Silvey, Linda. Polyhedra Dice Games, Grades 5 to 10. Creative Publications, 1978.

Smart, Margaret. Focus on Decimals. (2 Books), Activity Resources C., 1977.

Smart, Margaret & Tuel, Patricia. Focus on Fractions. (3 Books), Activity Resources Co., 1977.

Smart, Margaret. Focus on Percent. (1 Book), Activity Resources, 1978.

Stenzel, Jane. Instant Math. Prentice-Hall, 1975.

Stenzel, Jane. More Instant Math. Prentice-Hall, 1975.

Stokes, William. Gems of Geometry. Creative Publishing Co., 1978.

Stokes, William. Notable Numbers. Cuisenaire Co., 1972.

Swienciki, Lawrence. Adventures with Arithmetic Series. Creative Publications, 1974.
Book I Fractions, 1974
Book II Decimals, 1974
Book III Percent, 1974
Book IV Algebra, 1974

Tarte, Edward. Mathematical Discovery. J. Weston Walch, 1980.

Troutman, Andria P. & Lictenberg, Becky K. Mathematics: A Good Beginning. Brooks/Cole Publishing Co., 1977.

University of Oregon. Mathematics Resource Project. Creative Publishing Co., 1977.
Number Sense and Arithmetic Skills, 1977
Ratio, Proportion, and Scaling, 1977
Geometry and Visualization, 1977
Mathematics in Science and Society, 1977
Statistics and Information Organization, 1977

VCTM. Practical Ways to Teach the Basic Mathematical Skills. NCTM, 1978.

Yvon, Bernard & Downjng, Davis. Math Explorations with the Simple Calculator. J. Weston Walch, 1978.

DIRECTORY OF PUBLISHERS

Activity Resources Co.
P. O. Box 4875
Hayward, CA 94540

Carson-Dellosa Publications
P. O. Box 628
Akron, OH 44309

Creative Publications
P. O. Box 10328
Palo Alto, CA 94303

Cusienarie Company of America, Inc.
12 Church Street
New Rochele, NY 10805

Delta X Industries, Inc.
P. O. Box 313 D
Marinette, WI 54143

Educat Publishers, Inc.
P. O. Box 2891
Clinton, IA 52735

Educational Aids, Inc.
Encinitas, CA

Frank Schaffer Publications
26616 Indian Peak Road
Rancho Palos Verdes, CA 90274

Geyer Instructional Aids Company
P. O. Box 7306
Fort Wayne, IN 46807

J. Welston Walch, Publisher
Box 658
Portland, ME 04104

Key Curriculum Project
P. O. Box 2304
Berkeley, CA 94303

Love Publishing Co.
Denver, CO 80222

129

The Math Group, Inc.
396 East 79th Street Suite 1C
Minneapolis, MN 55420

Midwest Publications Company
P. O. Box 448
Pacific Grove, CA 93950

National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 22901

National Textbook Company
8259 Niles Center Road
Skokie, IL 60077

Prentice-Hall Learning System, Inc.
P. O. Box 527
San Jose, CA 95106

Shakean Stations, Inc.
P. O. Box 628
Farley, IA 52046

S.L.A.M. (Simple Lattice Approach to Mathematics)
Prentice-Hall Learning Systems, Inc.
Englewood Cliffs, NJ

Teacher's Market Place
16220 Orange Ave.
Paramount, CA 90723

PERIODICALS

The Arithmetic Teacher. National Council of Teachers of Mathematics, 1906 Association Drive, Reston, Virginia 22091.

The Center Fold. Twyla Sherman, P. O. Box 260, Andover, Kansas 67002.

Creative Computing. Creative Computing, P. O. Box 789-M, Morristown, New Jersey 07960.

Good Apple Newsletter. Grims and Mitchell, 710 Buchanan Street, Box 299, Carthage, Illinois 62321.

The Journal of Recreational Mathematics. Baywood Publishing Co., Inc., 43 Central Drive, Farmingdale, New York 11735.

Lollipops, Ladybugs, and Lucky Stars. Good Apple, Inc., Box 299, Carthage, Illinois 62321.

The Mathematics Teacher. NCTM, 1906 Association Drive, Reston, Virginia 22091.

Scholastic Math Magazine. 2280 Arbor Blvd., Dayton, Ohio 45439.

SPECIAL RESOURCES

Curriculum Guide: Elementary Mathematics. Tulsa Public Schools, 1980.

Curriculum Guide: ESEA Title I, Developmental Mathematics. Tulsa Public Schools, 1980.

Driscoll. Research Within Reach: Elementary School Mathematics. Research and Development Interpretation Service Cemkel, Inc., 3120 59th Street, St. Louis, Missouri, 63139.

Microsift: Microcomputer software and information for teachers. Don Holznagel, Coordinator, Northwest Educational Laboratory. 710 Southwest 2nd Avenue, Portland, Oregon, 97204.

National Council of Teachers of Mathematics. An Agenda for Action: Recommendations for School Mathematics in the 1980's. NCTM, 1980.

Suydam, M. Mathematics Education. (ASCD Curriculum Update, February, 1981). Association for Supervision and Curriculum Development, 225 North Washington St., Alexandria, Va., 22314. (Some copies are available from Mathematics Specialist, State Department of Education, 2500 North Lincoln Boulevard, Oklahoma City, Oklahoma, 73105.)

Project SEEK, Oklahoma State Department of Education, 2500 North Lincoln Boulevard, Oklahoma City, Oklahoma, 73105.

Project SEEK is a unique resource for Oklahoma educators. The services offered by Project SEEK are unique because it is the only place where Oklahoma public school educators K-12 can request searches of computerized data bases and order up to ten documents, all free of charge.

For MATHEMATICS-related requests, computer files such as ERIC (Educational Resources Information Center), or others can be searched at your specific request or as deemed appropriate.

If you would like a computer printout of ERIC document citations in a given subject area, simply relay your topic of interest or educational question to SEEK by phone, letter, request form, or visit. The printout contains descriptions of the materials cited and ordering information. When you receive the computer printout, you can then analyze the results yourself and request needed documents.

If it appears that more appropriate information is available on data bases other than the ERIC, then SEEK will do a computer search of them and send a printout. Materials cited on these other data bases, may be ordered from the original source, your nearest public library, through interlibrary loan, or from other recommended sources.

133

Evaluation

We wish to improve our products. Would you please help us by responding to the following:

1. Circle grade level(s) taught: K 1 2 3 4 5 6 7 8 9

2. Is the content of this publication generally appropriate for your grade level?

   ____ appropriate ____ inappropriate

3. Are the suggested activities:

   ____ most helpful ____ helpful ____ of little help?

4. What, in your opinion, is the major strength of this publication?

   _____

   _____

5. What, in your opinion, is the major weakness of this publication?

   _____

   _____

6. Please describe other types of mathematics publications or products which would be of assistance to you.

   _____

   _____

7. In the space below (or on an attached sheet) please share a successful teaching/learning activity with us.

   _____

   _____

   _____

Please return to:

Mathematics Specialist
State Department of Education
2500 N. Lincoln Blvd.
Oklahoma City, OK 73105